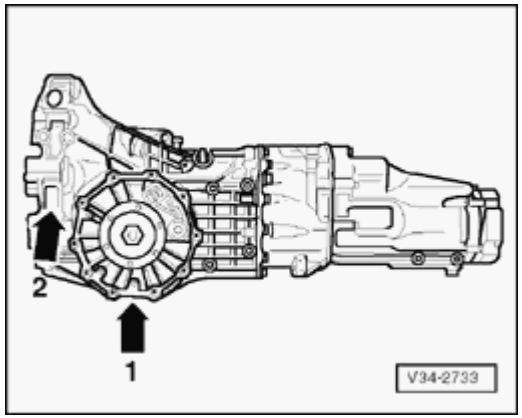
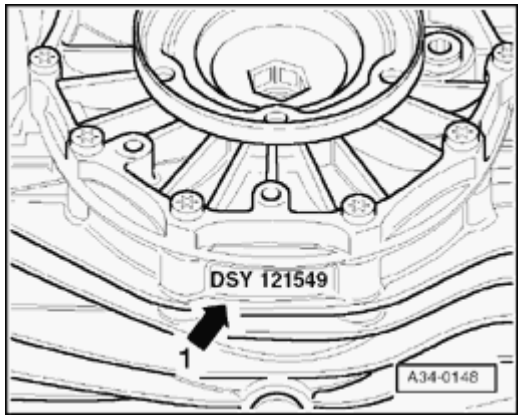
Transmission, identification

The 6-speed manual transmission 01E (all wheel drive) is installed in Audi S4 vehicles in conjunction with the 2.7 liter bi-turbo engine. Allocation ⇒ Page 00-3 .



Location on transmission

- Code letters and serial number (arrow -1-).
- Manual transmission 01E (arrow -2-).



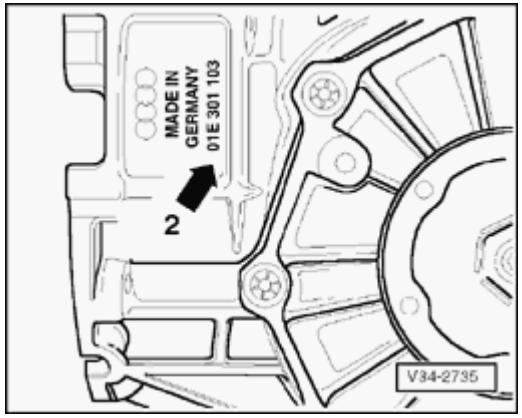
Code letters and transmission consecutive serial number (arrow -1-)

Example:	**EDU**	**136549**
	I	I
	Code letters	Transmission consecutive serial number

Additional data depends on manufacture.

Note:

The transmission code letters are also included on the vehicle data stickers.



Manual transmission 01E (arrow -2-)

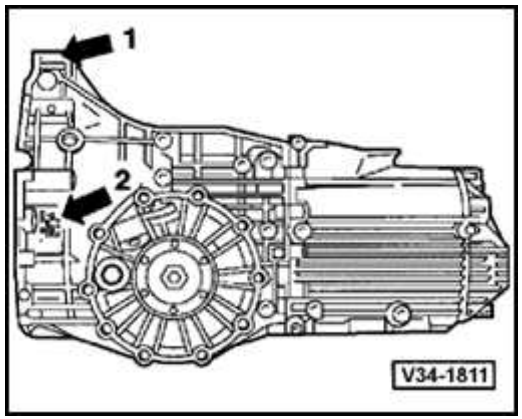
Code letters, allocation, ratios, and capacities

Manual transmission		**6-speed 01E all wheel drive**
Code letters		**EDU**
Manufactured	from	01.98
	to	
Allocation	Model	Audi A4 1995
	Engine	2.7 ltr. - 184 kW bi-turbo
Ratios:	Final drive	37 : 9 = 4.111
Z2 : Z1 = i	1st gear	28 : 8 = 3.500
	2nd gear	34 : 18 = 1.889
	3rd gear	32 : 26 = 1.231
	4th gear	29 : 30 = 0.967
	5th gear	29 : 36 = 0.806
	6th gear	26 : 38 = 0.684
	Reverse gear	38 : 11 = 3.455

Code letters	**EDU**
Speedometer	Electronic
Capacity	2.3 liters[1)]
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part number G 00 500 0
Clutch mechanism	Hydraulic
Clutch plate diameter	240 mm [2)]
Drive shaft flange diameter	108 mm
Overall ratio iov in top gear	2.813
Allocation: rear final drive (code letters)	DQA

1) With dual-mass flywheel

Transmission, identification

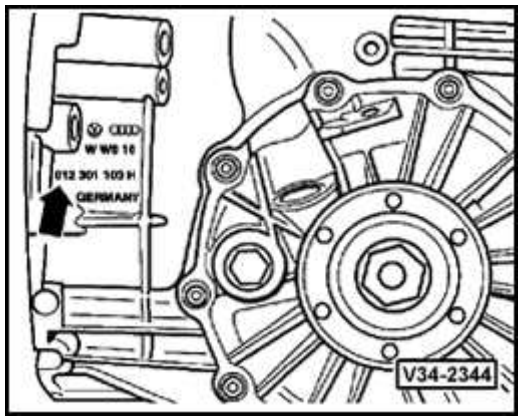


Location on transmission

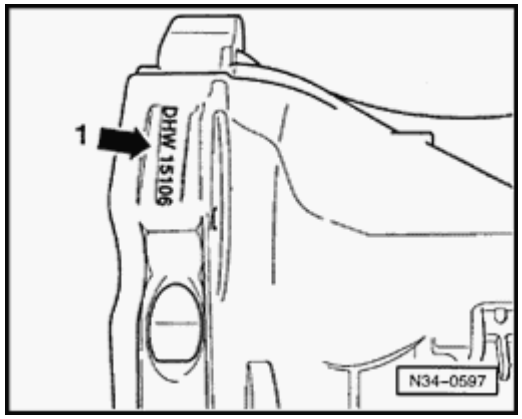
- Code letters and date of manufacture (arrow -1-)
- Manual transmission 012/01W (arrow -2-)

Note:

For organizational reasons, code "012" has been expanded to include code "01W." Both codes refer to the same transmission type.



Manual transmission 012/01W (arrow -2-)



Transmission code letters and date of manufacture (arrow -1-)

Example:	DHW	15	10	6
	I	I	I	I
	I	I	I	I
	Code letters	Day	Month	Year (1996) of manufacture

Additional information depends on manufacturing.

Note:

The transmission code letters are also listed on the vehicle data plates.

Code letters, transmission application, ratios, capacities

Manual transmission		**5-speed 012 front wheel drive**			
Code letters		**CTE**	**DHW 1)**	**CTJ**	**CWY**
Manufactured	from	11.94	07.96	11.94	11.94
	to	07.96		03.95	03.95
Application	Model	**Audi A4 1996**	**Audi A4 1996**	**Audi A4 1996**	**Audi A4 1996**
	Engine	1.8 L - 110 kW (150 hp)	1.8 L - 110 kW (150 hp)	2.8 L - 128 kW (172 hp)	2.8 L - 128 kW (172 hp)
Ratio: Z2 : Z1 = i	Final drive	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700
	1st Gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd Gear	36 : 17 = 2.118	36 : 17 = 2.118	35 : 19 = 1.842	35 : 18 = 1.944
	3rd Gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th Gear	35 : 34 = 1.029	35 : 34 = 1.029	33 : 35 = 0.943	33 : 35 = 0.943
	5th Gear	31 : 37 = 0.838	31 : 37 = 0.838	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse Gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

1) Modified transmission housing; transmission code DHW replaces CTE.

Code letters	**CTE**	**DHW 1)**	**CTJ**	**CWY**
Speedometer	electronic			
Capacity	2.25 liters (2.38 qts.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part number G 005 000 (1 liter)			
Clutch control	hydraulic	hydraulic	hydraulic	hydraulic
Clutch plate diameter	228 mm	228 mm	240 mm	240 mm
Drive shaft flange diameter	108 mm	108 mm	130 mm 2)	130 mm 2)
Polygon bearing	Yes	Yes	no	no
Overall ratio in high gear	3.100	3.100	2.921	2.921
2) Drive axle with triple rotor joint.				

Manual transmission		**5-speed 012/01W front wheel drive**			
Code letters		**CWZ**	**DHX 3)**	**DDK**	**DHY 4)**
Manufactured	from	01.95	07.96	03.96	07.96
	to	07.96		07.96	
Application	Model	**Audi A4 1996** ➢	**Audi A4 1996** ➢	**Audi A4 1996** ➢	**Audi A4 1996** ➢
	Engine	2.8 L - 128 kW (172 hp)	2.8 L - 128 kW (172 hp)	2.8 L - 142 kW (191 hp)	2.8 L - 142 kW (191 hp)
Ratio:	Final drive	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700	37 : 10 = 3.700
Z2 : Z1 = i	1st Gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd Gear	35 : 18 = 1.944	35 : 18 = 1.944	35 : 18 = 1.944	35 : 18 = 1.944
	3rd Gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th Gear	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943
	5th Gear	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse Gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

3) Modified transmission housing; transmission code DHX replaces CWZ.

4) Modified transmission housing; transmission code DHY replaces DDK.

Code letters	**CWZ**	**DHX 3)**	**DDK**	**DHY 4)**
Speedometer	electronic			
Capacity	2.25 liters (2.38 qts.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part number G 005 000 (1 liter)			
Clutch control	hydraulic	hydraulic	hydraulic	hydraulic
Clutch plate diameter	240 mm	240 mm	240 mm	240 mm
Drive shaft flange diameter	130 mm 2)	130 mm 2)	130 mm 2)	130 mm 2)
Polygon bearing	Yes	Yes	Yes	Yes
Overall ratio in high gear	2.921	2.921	2.921	2.921

2) Drive axle with triple rotor joint.

3) Modified transmission housing; transmission code DHX replaces CWZ.

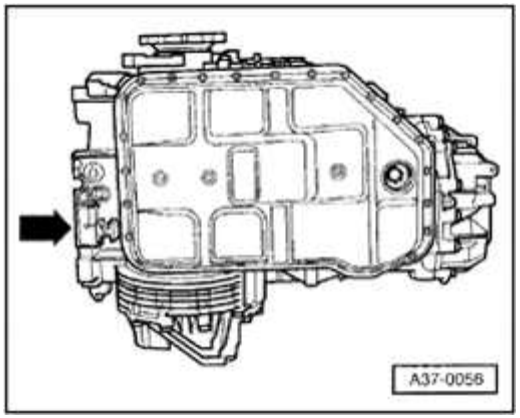
4) Modified transmission housing; transmission code DHY replaces DDK.

00-1

Transmission identification

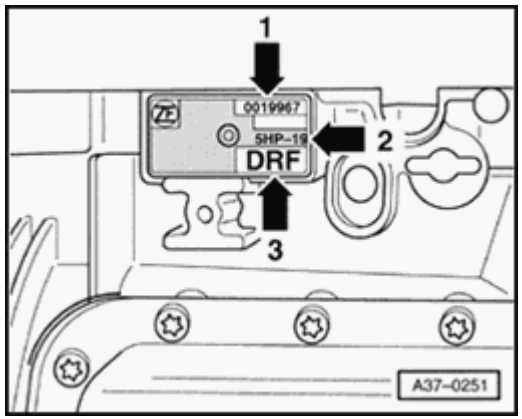
The 5-speed automatic transmission 01V is installed in the Audi A4 1996 ➢ in conjunction with the 4 and 6-cylinder engines. Allocation ⇒ Page 00-4 .

Code letter allocation at transmission



➢ Transmission code letters are located on the data plate under the transmission (arrow).

There is another identical data plate on side of transmission which is not accessible with the transmission installed.



➢ Transmission code number and transmission serial number.

Transmission serial number (arrow 1),Transmission identification (arrow 2),Code letter (arrow 3)

The transmission code letters are also listed on the vehicle data plates.

5-speed automatic transmission 01V, notes

Self-study program No.. 180 informs extensively about the function of this transmission.

Torque converter

The torque converter is equipped with a lock-up clutch. The lock-up clutch is closed load- and speed-dependant with minimum pulsations and mechanically drives the 3., 4. and 5. gear independent of slip.

Transmission

5-speed automatic transmission 01V is equipped with 5 hydraulically activated forward gears. By passing the torque converter slip, these forward gears become mechanically driven gears if the lock-up clutch is closed.

Hydraulic control

There is a distinction made between two types of transmission. Transmissions with hydraulic control E17, the sensor for transmission RPM (inductive sensor) is secured to bottom of valve body. Transmissions with hydraulic control E18/2, the sensor for transmission RPM (hall effect sensor) is secured to transmission housing behind valve body.

Information regarding which transmission is installed can be found in tables ⇒ page 00-4 onward.

On Board Diagnostic (OBD)

On Board Diagnostic (OBD) is described in:

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01*

00-4

Code letters, allocation, ratios, equipment

Front Wheel Drive (FWD)

Automatic transmission		01V.J	01V.F	01V.F
Transmission	Code letters	**DDT**	**DRD**	**EBX**
	Manufactured from	09.96	03.97	07.99
	to	08.99	07.99	
Torque converter	Code letters	**M28**	**F31**	**F31**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	1.8 L 5V - 110 kW	2.8 L 5V - 142 kW	2.8 L 5V - 142 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

Transmission	Code letters		**DDT**	**DRD**	**EBX**
Intermediate drive	Number of teeth	Drive gear	29	29	29
		Output gear	35	35	35
	Ratio		1.207	1.207	1.207
Final drive	Number of teeth	Drive pinion	11	11	11
		Ring gear	34	30	30
	Ratio		3.091	2.727	2.727
CAN-bus			without CAN-bus	with CAN-bus	with CAN-bus
E-Gas[1)]			without E-Gas	without E-Gas	with E-Gas
Hydraulic control			Park/Neutral Position (PNP) Switch -E17-	Park/Neutral Position (PNP) Switch -E17-	Rear Fog Light Switch -E18-/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

00-6

Automatic transmission		01V.J	01V.J	01V.J
Transmission	Code letters	**EFP**	**EFP**	**EKC**
	Manufactured from	09.99	05.00	08.99
	to			
Torque converter	Code letters	**M28**	**M28**	**F31**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	1.8 L 5V - 110 kW 210 Nm (LEV)	1.8 L 5V - 125 kW 240 Nm (ULEV)	2.8 L 5V - 142 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

Transmission	Code letters		**EFP**	**EFP**	**EKC**
Intermediate drive	Number of teeth	Drive gear	29	29	29
		Output gear	35	35	35
	Ratio		1.207	1.207	1.207
Final drive	Number of teeth	Drive pinion	11	11	11
		Ring gear	34	34	34
	Ratio		3.091	3.091	3.091
CAN-bus			with CAN-bus	with CAN-bus	with CAN-bus
E-Gas[1)]			with E-Gas	with E-Gas	with E-Gas
Hydraulic control			Rear Fog Light Switch - E18-/2	Rear Fog Light Switch - E18-/2	Rear Fog Light Switch - E18-/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

Automatic transmission		01V.J	01V.J
Transmission	Code letters	**EZS**	**EZZ**
	Manufactured from	06.00	06.00
	to		
Torque converter	Code letters	**A33**	**M28**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	1.8 L 5V - 125 kW	2.8 L 5V - 142 kW
Ratios	1. Gear	3.665	3.665
	2. Gear	1.999	1.999
	3. Gear	1.407	1.407
	4. Gear	1.000	1.000
	5. Gear	0.742	0.742
	Reverse gear	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

Transmission	Code letters		**EZS**	**EZZ**
Intermediate drive	Number of teeth	Drive gear	29	29
		Output gear	35	35
	Ratio		1.207	1.207
Final drive	Number of teeth	Drive pinion	11	11
		Ring gear	34	34
	Ratio		3.091	3.091
CAN-bus			with CAN-bus	with CAN-bus
E-Gas[1)]			with E-Gas	with E-Gas
Hydraulic control			Rear Fog Light Switch -E18-/2	Rear Fog Light Switch -E18-/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

All Wheel Drive (AWD)

Automatic transmission		**01V.4**	**01V.4**	**01V.4**
Transmission	Code letters	**DKB**	**DTV**	**EFQ**
	Manufactured from	07.96	03.97	08.98
	to	02.97	07.99	
Torque converter	Code letters	**M28**	**M28**	**M28**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	1.8 L 5V - 110 kW	1.8 L 5V - 110 kW	1.8 L 5V - 110 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

00-11

Transmission	Code letters		DKB	DTV	EFQ
Intermediate drive-Va	Number of teeth	Drive gear	29	29	29
		Output gear	35	35	35
	Ratio		1.207	1.207	1.207
Final drive-Va	Number of teeth	Drive pinion	11	11	11
		Ring gear	34	34	34
	Ratio		3.091	3.091	3.091
intermediate drive-HA	Number of teeth	Drive gear	41	41	41
		Output gear	37	37	37
	Ratio		0.902	0.902	0.902
Final drive-HA	Number of teeth	Drive pinion	9	9	9
		Ring gear	37	37	37
	Ratio		4.111	4.111	4.111
CAN-bus			without CAN-bus	without CAN-bus	with CAN-bus
E-Gas[1)]			without E-Gas	without E-Gas	with E-Gas

Hydraulic control	Park/Neutral Position (PNP) Switch -E17-	Park/Neutral Position (PNP) Switch -E17-	Rear Fog Light Switch -E18-/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

00-12

Automatic transmission		01V.3	01V.3	01V.4
Transmission	Code letters	**DRN**	**ECG**	**FAL**
	Manufactured from	03.97	08.99	06.00
	to	08.99		
Torque converter	Code letters	**F31**	**F31**	**A33**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	2.8 L 5V - 142 kW	2.8 L 5V - 142 kW	1.8 L 5V - 125 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

00-13

Transmission	Code letters		**DRN**	**ECG**	**FAL**
Intermediate drive-Va	Number of teeth	Drive gear	29	29	29
		Output gear	35	35	35
	Ratio		1.207	1.207	1.207
Final drive-Va	Number of teeth	Drive pinion	11	11	11
		Ring gear	30	30	34
	Ratio		2.727	2.727	3.091
intermediate drive-HA	Number of teeth	Drive gear	41	41	41
		Output gear	33	33	37
	Ratio		0.805	0.805	0.902
Final drive-HA	Number of teeth	Drive pinion	9	9	9
		Ring gear	37	37	37
	Ratio		4.111	4.111	4.111
CAN-bus			with CAN-bus	with CAN-bus	with CAN-bus
E-Gas[1)]			without E-Gas	with E-Gas	with E-Gas
Hydraulic control			E17	E18/2	E18/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

00-14

Automatic transmission		01V.4	01V.2	01V.Z
Transmission	Code letters	**EKD**	**EDF**	**EMP**
	Manufactured from to	08.99	04.99	08.99
Torque converter	Code letters	**N28**	**D34**	**D34**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	2.8 L 5V - 142 kW	2.7 L 5V - 184 kW	2.7 L 5V - 184 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

00-15

Transmission	Code letters		**EKD**	**EDF**	**EMP**
Intermediate drive-Va	Number of teeth	Drive gear	29	29	29
		Output gear	35	29	35
	Ratio		1.207	1.000	1.207
Final drive-Va	Number of teeth	Drive pinion	11	11	11
		Ring gear	34	34	32
	Ratio		3.091	3.091	2.909
Intermediate drive-HA	Number of teeth	Drive gear	41	43	41
		Output gear	37	34	37
	Ratio		0.902	0.791	0.902
Final drive-HA	Number of teeth	Drive pinion	9	9	9
		Ring gear	37	35	35
	Ratio		4.111	3.889	3.889
CAN-bus			with CAN-bus	with CAN-bus	with CAN-bus
E-Gas[1)]			with E-Gas	with E-Gas	with E-Gas
Hydraulic control			E18/2	E18/2	E18/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program No.. 210.

00-16

Automatic transmission		01V.Z	01V.Z	01V.4
Transmission	Code letters	**FAQ**	**FHJ**	**FAS**
	Manufactured from to	06.00	06.00	05.00
Torque converter	Code letters	**F35**	**F35**	**N28**
Allocation	Model	Audi A4 1996➢ USA	Audi A4 1996➢ USA	Audi A4 1996➢ USA
	Engine	2.7 L 5V - 184 kW	2.7 L 5V - 184 kW	2.8 L 5V - 142 kW
Ratios	1. Gear	3.665	3.665	3.665
	2. Gear	1.999	1.999	1.999
	3. Gear	1.407	1.407	1.407
	4. Gear	1.000	1.000	1.000
	5. Gear	0.742	0.742	0.742
	Reverse gear	4.096	4.096	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

00-17

Transmission	Code letters		**FAQ**	**FHJ**	**FAS**
Intermediate drive-Va	Number of teeth	Drive gear	29	29	29
		Output gear	35	35	35
	Ratio		1.207	1.207	1.207
Final drive-Va	Number of teeth	Drive pinion	11	11	11
		Ring gear	32	32	34
	Ratio		2.909	2.909	3.091
intermediate drive-HA	Number of teeth	Drive gear	41	41	41
		Output gear	37	37	37
	Ratio		0.902	0.902	0.902
Final drive-HA	Number of teeth	Drive pinion	9	9	9
		Ring gear	35	35	37
	Ratio		3.889	3.889	4.111
CAN-bus			with CAN-bus	with CAN-bus	with CAN-bus
E-Gas[1)]			with E-Gas	with E-Gas	with E-Gas
Hydraulic control			E18/2	E18/2	E18/2

1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program nr. 210.

00-18

Automatic transmission		**01V.4**
Transmission	Code letters	**FHH**
	Manufactured from to	06.00
Torque converter	Code letters	**N28**
Allocation	Model	Audi A4 1996➢ USA
	Engine	2.8 L 5V - 142 kW
Ratios	1. Gear	3.665
	2. Gear	1.999
	3. Gear	1.407
	4. Gear	1.000
	5. Gear	0.742
	Reverse gear	4.096

Valve body allocation according to transmission code letters

⇒ *Parts Catalog*

00-19

Transmission	Code letters		**FHH**
Intermediate drive-Va	Number of teeth	Drive gear	29
		Output gear	35
	Ratio		1.207
Final Drive-Va	Number of teeth	Drive pinion	11
		Ring gear	34
	Ratio		3.091
Intermediate drive-HA	Number of teeth	Drive gear	41
		Output gear	37
	Ratio		0.902
Final drive-HA	Number of teeth	Drive pinion	9
		Ring gear	37
	Ratio		4.111
CAN-bus			with CAN-bus
E-Gas[1)]			with E-Gas
Hydraulic control			E18/2

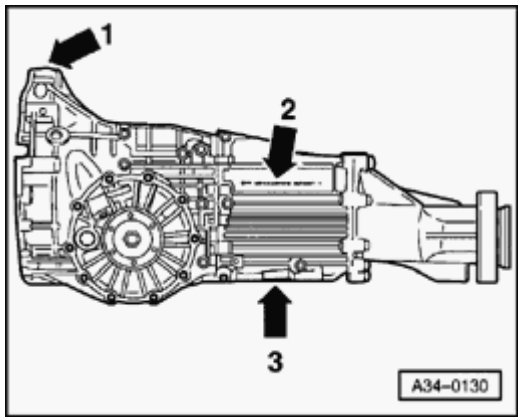
1) "E-Gas" is the general abbreviation for electronic engine power regulation, more information on this can be found in self-study program nr. 210.

00-1

Transmission identification

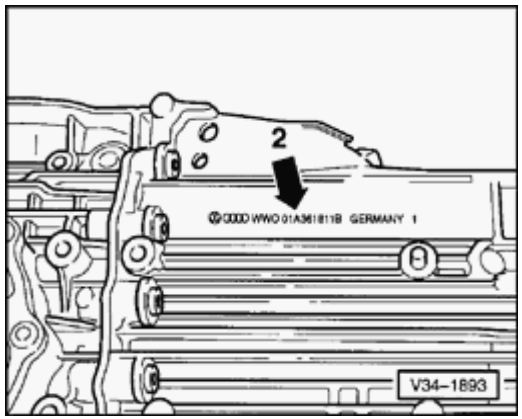
The manual transmission 01A AWD is installed in the Audi A4 1998 ➢as a 5-speed transmission in conjunction with the 4-cylinder turbo engine or 6-cylinder engine.

Applications ⇒ Page 00-3 .

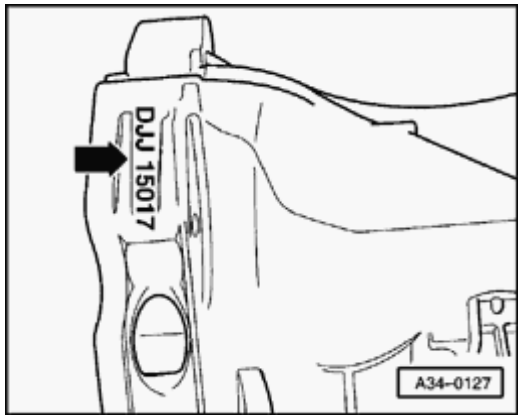


➢ Locations on transmission

- Code letters and date of manufacture (arrow -1-).
- Manual transmission 01A (arrow -2-).
- Code letters (arrow -3-).



➢ Manual transmission 01A (arrow -2-)



Code letters and date of manufacture (arrow -1-)

Example:	DJJ	15	01	7
	I	I	I	I
	I	I	I	I
	Transmission code letters	Day	Month	Year
		Date (e.g. 15 Jan. 1997)		

Additional data is pre-production related.

Note:

The code letters of the transmission are engraved on the lower part of the transmission cover and are also engraved on the vehicle data plates.

Code letters, engine/transmission applications, ratios, capacities

Transmission 01A all-wheel-drive **Code letters**		**CTF**	**DJJ**	**CXF**	**CXW**
Manufactured	from:	11.94	07.96	11.94	11.94
	to:	07.96	-	11.94	07.96
Application	Model	**Audi A4 1996**	**Audi A4 1996**	**Audi A41996**	**Audi A4 1996**
	Engine	1.8 ltr - 110 kW (150 hp)	1.8 ltr - 110 kW (150 hp)	2.8 ltr -128 kW (172 hp)	2.8 ltr -128 kW (172 hp)
Ratios	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
Z2 : Z1 = i	1st gear	34 : 9 = 3.778	34 : 9 = 3.778	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	37 : 17 = 2.176	37 : 17 = 2.176	35 : 18 = 1.944	35 : 18 = 1.944
	3rd gear	40 : 28 = 1.429	40 : 28 = 1.429	39 : 30 = 1.300	39 : 30 = 1.300
	4th gear	35 : 34 = 1.029	35 : 34 = 1.029	33 : 35 = 0.943	33 : 35 = 0.943
	5th gear	31 : 37 = 0.838	30 : 37 = 0.838	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444

Continued on next Page

00-4

Transmission 01A all-wheel-drive **Code letters**	**CTF**	**DJJ**	**CXF**	**CXW**
Speedometer	Electronic			
Capacity	2.75 liter (2.91 qt.)			
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)			
Clutch mechanism	Hydraulic			
Clutch plate diameter	228 mm (8.98 in.)	228 mm (8.98 in.)	240 mm (9.45 in.)	240 mm (9.45 in.)
Drive shaft flange diameter	100 mm (3.94 in.)			
Overall ratio iov in top gear	3.258	3.258	3.070	3.070
Application: rear final drive **(code letters)**	CKH DAJ	DAJ	CKH	CKH

00-5

Transmission 01A all-wheel-drive **Code letters**		**DJP**	**DDL**	**DJR**
Manufactured	from:	07.96	03.96	07.96
	to:	07.97	07.96	-
Application	Model	**Audi A4 1996** ➢	**Audi A4 1996** ➢	**Audi A41996** ➢
	Engine	2.8 ltr - 128 kW (172 hp)	2.8 ltr - 142 kW (190 hp)	2.8 ltr -142 kW (190 hp)
Ratios	Final drive	35 : 9 = 3.889	35 : 9 = 3.889	35 : 9 = 3.889
Z2 : Z1 = i	1st gear	35 : 10 = 3.500	35 : 10 = 3.500	35 : 10 = 3.500
	2nd gear	35 : 18 = 1.944	35 : 18 = 1.944	35 : 18 = 1.944
	3rd gear	39 : 30 = 1.300	39 : 30 = 1.300	39 : 30 = 1.300
	4th gear	33 : 35 = 0.943	33 : 35 = 0.943	33 : 35 = 0.943
	5th gear	30 : 38 = 0.789	30 : 38 = 0.789	30 : 38 = 0.789
	Reverse gear	31 : 9 = 3.444	31 : 9 = 3.444	31 : 9 = 3.444
Continued on next Page				

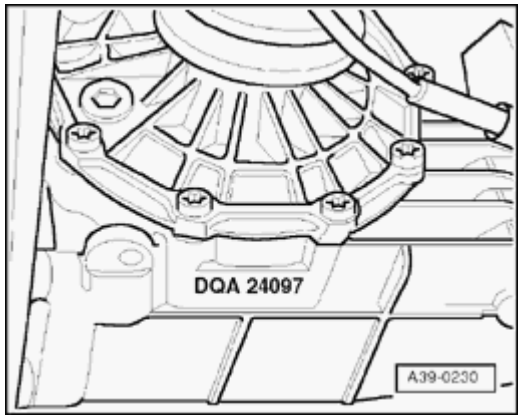
00-6

Transmission 01A all-wheel-drive **Code letters**	**DJP**	**DDL**	**DJR**
Speedometer	Electronic		
Capacity	2.75 liter (2.906 qt.)		
Specification	Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)		
Clutch mechanism	Hydraulic		
Clutch plate diameter	240 mm (9.45 in.)	240 mm (9.45 in.)	240 mm (9.45 in.)
Drive shaft flange diameter	100 mm (3.94 in.)		
Overall ratio iov in top gear	3.070	3.070	3.070
Application: rear final drive (code letters)	DAJ	CKH DAJ	DAJ

Rear final drive, identification

Final drive 01H is fitted in conjunction with manual transmission 01E (all wheel drive).

Allocation ⇒ Page 00-6



Code letters and date of manufacture of rear final drive:

Example:	**DQA**	**24**	**09**	**7**
	I	I	I	I
	Code letters	Day	Month	Year (1997) of manufacture

Note:

The code letters of the rear final drive are also included on the vehicle data stickers.

Code letters, allocation, ratios and capacities

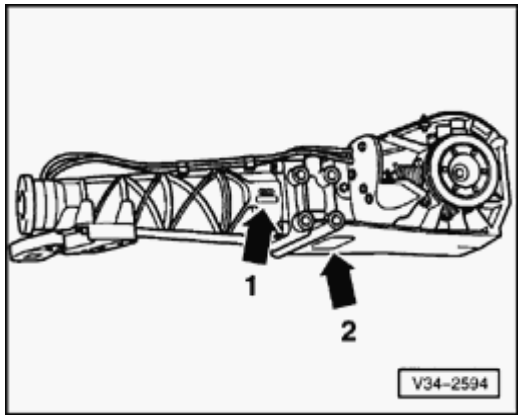
Rear final drive		**01H**	
Code letters		**DQA**	
Manufactured	from	01.99	
	to		
Allocation	Model	Audi A4 1995	
	Engine	2.7 ltr. - 195 kW bi-turbo	
Ratios	Final drive	37 : 9 = 4.111	
Capacity		1.9 Liter	
Specification		Gear oil: SAE 75 W 90 (synthetic oil) Part number G 00 500 0	
Drive shaft flange diameter		108 mm	
Allocation: manual transmission (code letters)		EDU	

00-7

Rear final drive identification

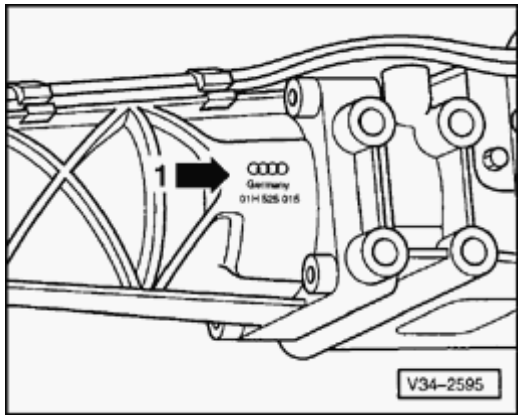
Rear final drive O1H is installed in combination with manual transmission 01A for AWD vehicles.

Applications ⇒ Page 00-9 .

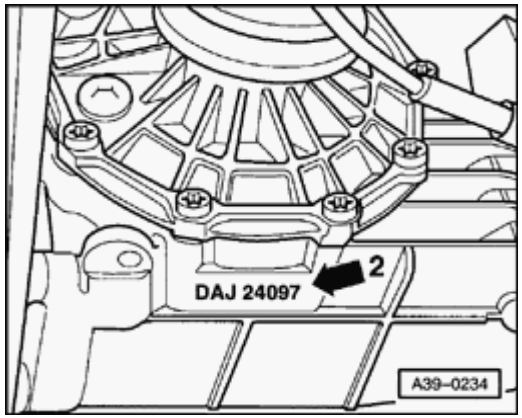


Location on rear final drive

- Rear final drive 01H (arrow -1-).
- Code letters and date of manufacture (arrow -2-).



- **01H rear final drive (arrow -1-)**



- Code letters and date of manufacture (arrow -2-)

Example:	DAJ	24	09	7
	I	I	I	I
	I	I	I	I
	Transmission code letters	Day	Month	Year
		Date (e.g. 24 Sep. 1997)		

Note:

The code letters of the rear final drive are also listed on the vehicle data stickers.

00-9

Code letters, engine/transmission applications, ratios, capacities

Rear final drive **Code letters**		**CKH**	**DAJ**
Manufactured	from	07.94	05.96
	to	06.96	
Application	Model	Audi A4 1996 ➢	Audi A4 1996 ➢
	Engine	1.8 ltr - 110 kW (150 hp)	1.8 ltr - 110 kW (150 hp)
		2.8 ltr - 128 kW (172 hp)	2.8 ltr - 128 kW (172 hp)
		2.8 ltr - 142 kW (190 hp)	2.8 ltr - 142 kW (190 hp)
Ratios	Rear final drive	35 : 9 = 3.889	35 : 9 = 3.889
Capacity		1.9 liter (2.01 qt.)	
Specification		Gear oil: SAE 75 W 90 (synthetic oil) Part Number: G 005 000 (1 Liter)	
Drive shaft flange diameter		100 mm (3.94 in.)	
Application: manual transmission (code letters)		CTF CXF	CTF DJJ

	CXW DDL	DJP DDL DJR

Calculations

Transmission ratio "i," computing

Transmission ratio

Transmission ratio	=	No. of teeth driven gear	:	No. of teeth drive gear

Ratios			Formula
iG	=	gear ratio	ZG2 : ZG1
iA	=	axle ratio	ZA2 : ZA1
iov	=	overall ratio	iG x iA

Example:

	5th Gear	Final drive
Drive gear	ZG1 = 38	ZA1 = 10
Driven gear	ZG2 = 30	ZA2 = 37

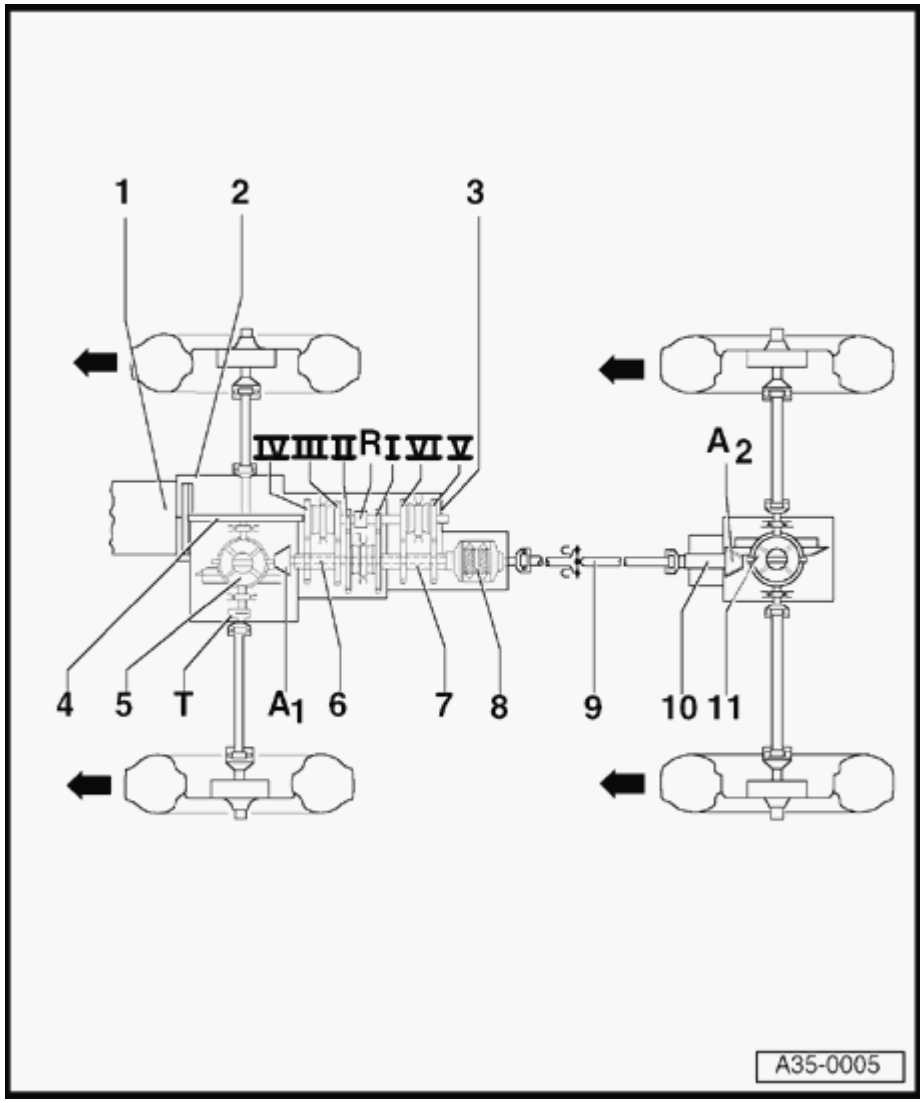
Calculating:

iG = 30 : 38 = 0.789

iA = 37 : 10 = 3.700

iov = (30 : 38) x (37 : 10) = 0.789 x 3.700 = 2.921

00-7



Transmission layout

1 - Engine

2 - Clutch

3 - Transmission

4 - Input shaft (main shaft)

5 - Front differential

6 - Front drive pinion (output shaft)

7 - Hollow shaft

8 - Torsen differential

9 - Driveshaft

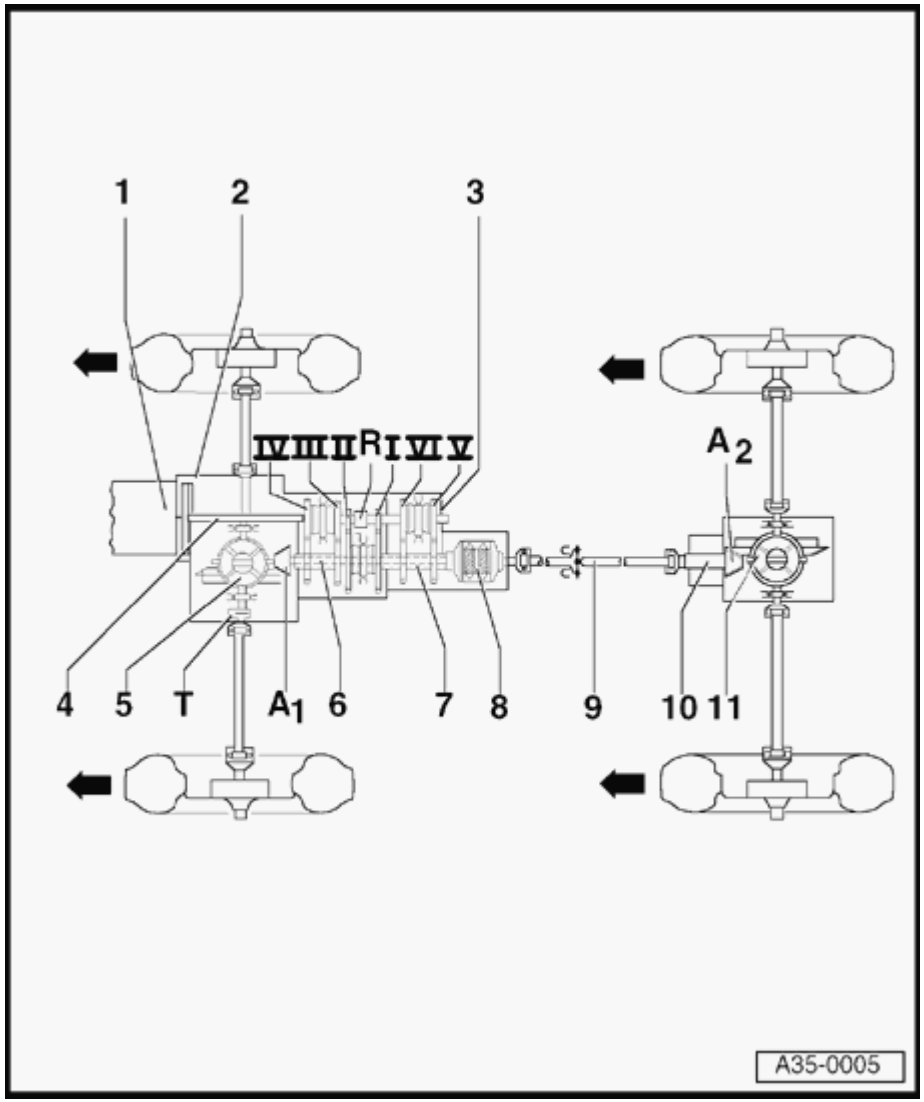
10 - Rear drive pinion

11 - Rear differential

Note:

Arrows point in forward direction of travel.

00-8



I - 1st gear

II - 2nd gear

III - 3rd gear

IV - 4th gear

V - 5th gear

VI - 6th gear

R - Reverse gear

A1 - Front final drive

A2 - Rear final drive

T - Speedometer drive, electronic

Note:

Arrows point in forward direction of travel.

Notes for performance test, brake test and tow starting/towing

Performance test on roller type test stand

The following must be noted when a vehicle with all wheel drive is to be driven onto a performance test stand:

- A four wheel test stand with four braked rollers must be used.

Brake test on the roller type test stand

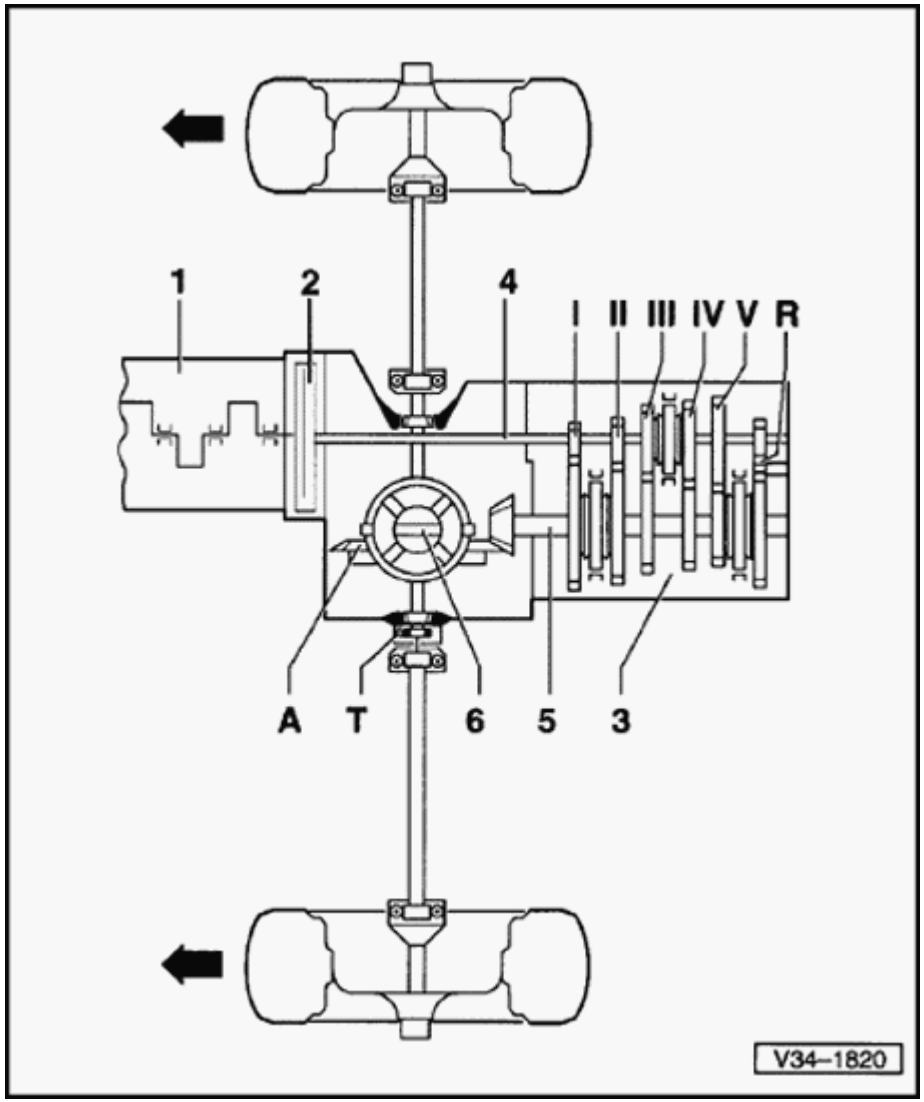
The following must be noted when a vehicle with all wheel drive is to be driven onto a roller type test stand:

- A slow moving brake test stand (to 5,5 km/h) must be used. During this, no gear may be selected.

Tow starting and towing vehicles

⇒ *Repair Manual, Maintenance*

00-8



Drivetrain, overview

1 - Engine

2 - Clutch

3 - Manual transmission

4 - Input shaft (main shaft)

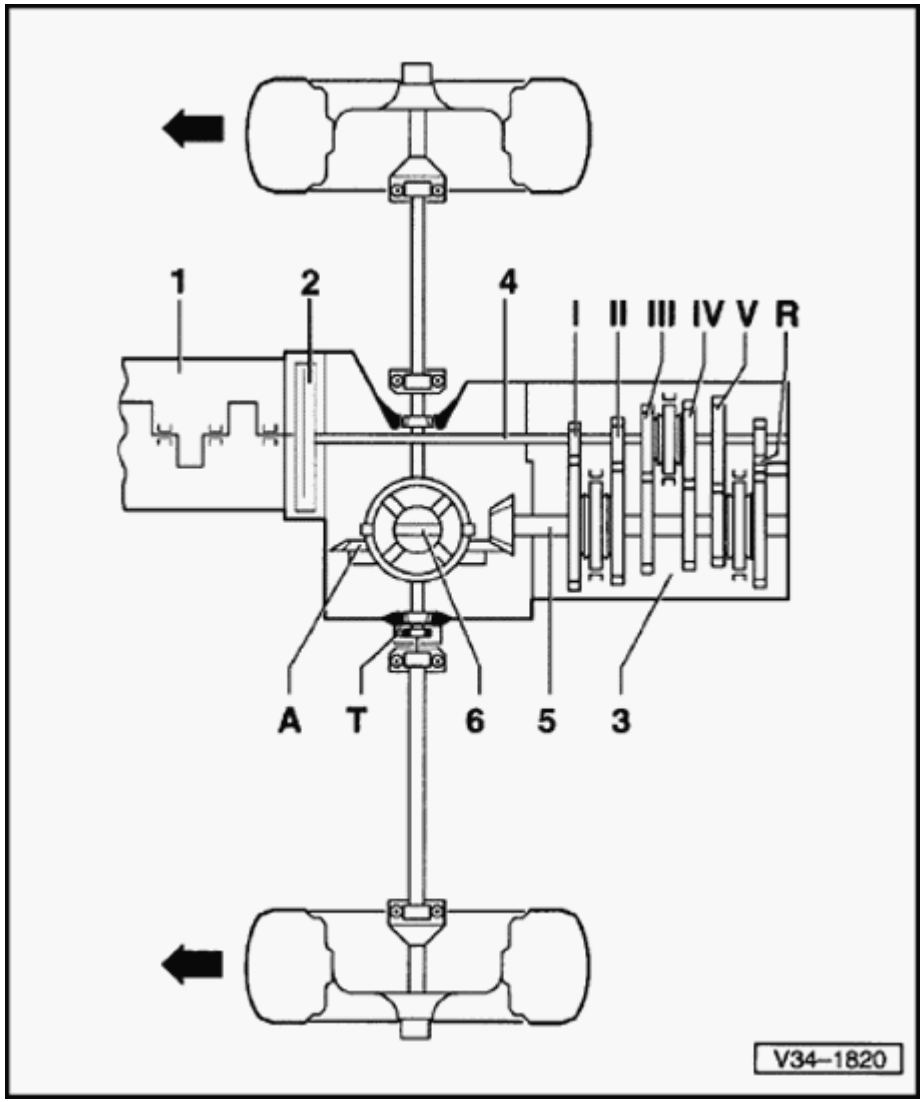
5 - Pinion shaft (output shaft)

6 - Differential

Note:

Arrows point in direction of travel.

00-9



I - 1st Gear

II - 2nd Gear

III - 3rd Gear

IV - 4th Gear

V - 5th Gear

R - Reverse Gear

A - Final drive

T - Speedometer drive (electronic)

Note:

Arrows point in direction of travel.

General repair instructions

The maximum possible care, cleanliness and proper tools are essential to ensure satisfactory and successful transmission repairs. The usual basic safety precautions also apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Repair Manual, are summarized here. They apply to this Repair Manual.

Special tools and equipment

For a complete list of special tools and equipment used in this repair manual ⇒ "Special tools catalog."

Transmission

- Using parts catalog microfiche, match bolts and other components according to transmission codes ⇒ Page 00-3 .
- After replacing the manual transmission , check oil level and top-up if necessary ⇒ Page 34-36 .
- Capacities and specifications ⇒ Page 00-3 .

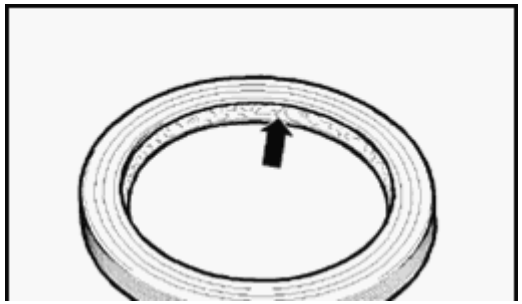
- Thoroughly clean all connections and the surrounding area before disconnecting.
- When installing transmission, make sure centering sleeves for aligning engine and transmission are correctly seated.

Sealants

- Thoroughly clean housing joint surfaces before applying sealant.
- Apply sealant AMV 188 000 02 or AMV 188 001 02 evenly and not too thick.
- Breather holes must be free of sealant.

O-rings, gaskets, seals

- Always replace O-rings, gaskets and seals.
- After removing gaskets and seals, always inspect the contact surfaces on the housing or shaft for burrs resulting from removal, or for other signs of damage.
- Thoroughly clean housing joint surfaces before assembling.



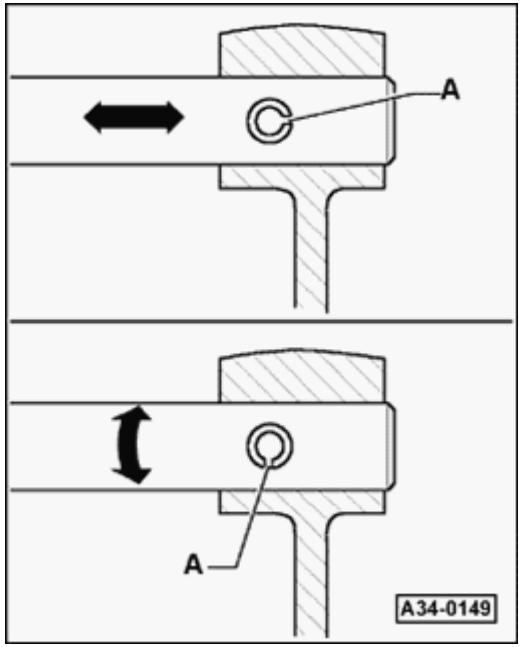
- Before installing radial shaft seals, lightly oil outer edge and fill space between sealing lip and dust lip (arrow) with oil.
- Open side of the seal faces toward the side containing the oil.
- When replacing seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).

- Lightly lubricate O-rings before installing. This prevents the rings from being pinched while being inserted.
- Check transmission oil level after replacing gaskets and seals ⇒ Page 34-36 .

00-12

Circlips

- Do not over-stretch circlips.
- Always replace.
- Circlips must be fully seated in groove.



- Always replace roll pins.
- Installed position: slot -A- is longitudinal to line of force (arrow).

Nuts, bolts

- Always replace self-locking nuts and bolts.
- Loosen nuts or bolts opposite to torque sequence.
- Tighten and loosen bolts or nuts for securing covers and housings in a diagonal sequence.
- The tightening torques stated apply to non-oiled nuts and bolts.
- The threads of bolts which are secured by a locking compound should be cleaned using a wire brush. Then apply AMV 185 101 A1 when installing.
- Threaded holes for self-locking bolts or bolts coated with locking fluid must be cleaned with tap. Otherwise there is a danger of bolts shearing when subsequently being removed.

Bearings

- Install needle bearings with the lettering on the bearing (the side with thicker metal) facing the drift.
- Mark needle bearings of drive gears for first through fifth sliding gears when removing to ensure the same installed position when installing.
- Grease needle bearing for input shaft in flywheel.
- Lubricate all bearings in transmission with transmission fluid before installing.
- Heat tapered roller bearing inner races to approx. 100 ° C (212 ° F) before installing. Press in to stop so that there is no axial play.
- Do not interchange inner and outer bearing races with those from other bearings of the same size.
- Always replace tapered roller bearings on one shaft together and use new bearings from the same manufacturer.

- The tapered roller bearings for the output shaft and the differential in the manual transmission are low-friction bearings. Do not additionally oil new tapered roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.

Shims

- Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- Check for burrs and signs of damage.

Sliding Gears

- After assembling, check axial play of 1st to 5th sliding gears (0.15-0.35 mm) and check for free movement.

Synchronizer rings

- Do not interchange. When re-using, install synchronizer rings with the same gear with which they were matched.
- Check for signs of wear; replace if necessary.
- Lubricate with transmission fluid before installing.

Gears, synchro-hubs, inner races for sliding gears

- Heat gears and synchro-hubs to approx. 100 °C (212 °F) before installing. Press into stop so there is no axial play.
- Heat inner races for sliding gears to approx. 100 °C (212 °F) before installing.
- The temperature can be checked using VAG1558 temperature tester.
- Note installation position.

Clutch mechanism

- When removing transmission, remove clutch slave cylinder without disconnecting lines.
- Do not depress the clutch pedal after removing the slave cylinder if the hydraulic line is still connected. Otherwise the piston will be pressed out of the slave cylinder.
- Do not cant clutch pressure plate; loosen and tighten in a diagonal sequence and in stages.
- If the clutch has burnt out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission in order to reduce the smell of burnt linings.

Overall ratio "i," calculating

Transmission ratio

Transmission ratio	=	No. of teeth driven gear	:	No. of teeth drive gear

Ratios			**Formula**
i_G	=	gear ratio	$ZG_2 : ZG_1$
i_A	=	axle ratio	$ZA_2 : ZA_1$
i_{ov}	=	overall ratio	$i_G \times i_A$

Example:

	6th gear	**Final drive**
Drive gear	$ZG_1 = 38$	$ZA_1 = 9$
Driven gear	$ZG_2 = 26$	$ZA_2 = 37$

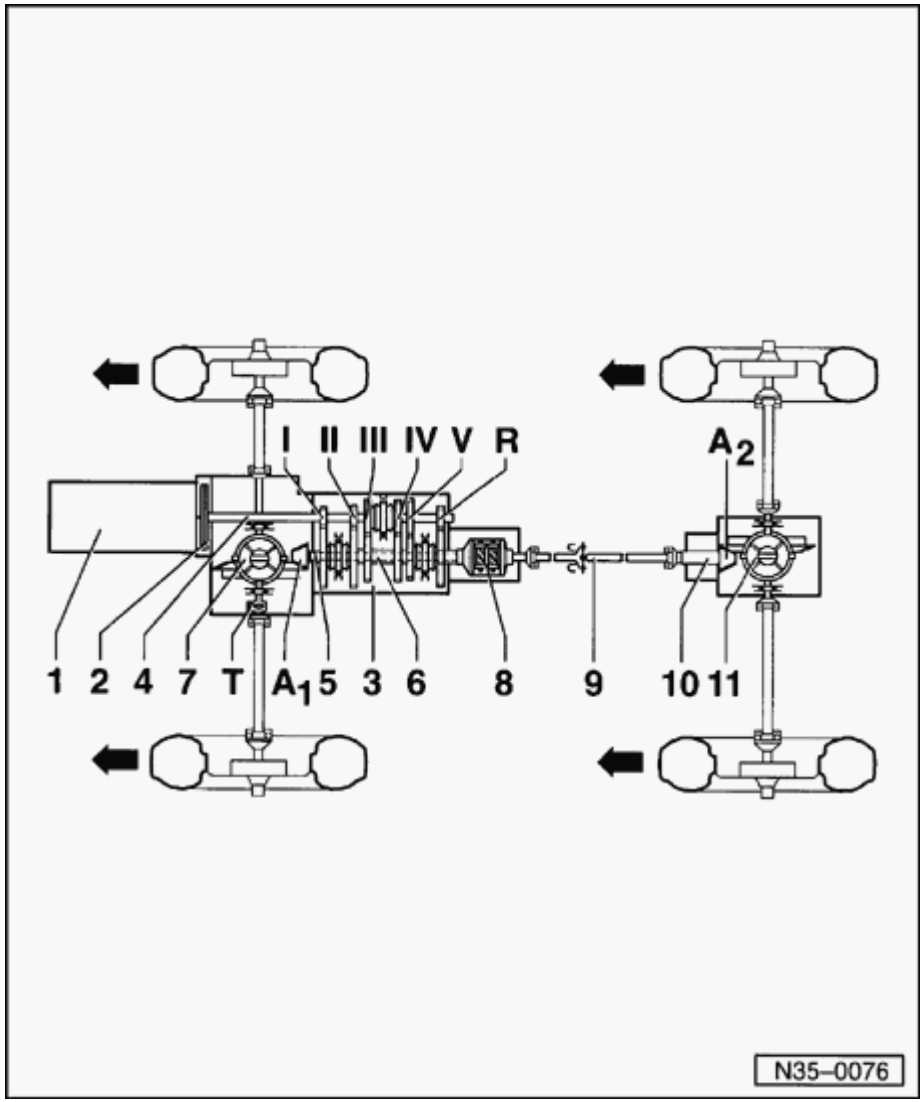
Calculating:

i_G = 26 : 38 = 0.684

i_A = 37 : 9 = 4.111

i_{ov} = (26 : 38) x (37 : 9) = 0.684 x 4.111 = 2.813

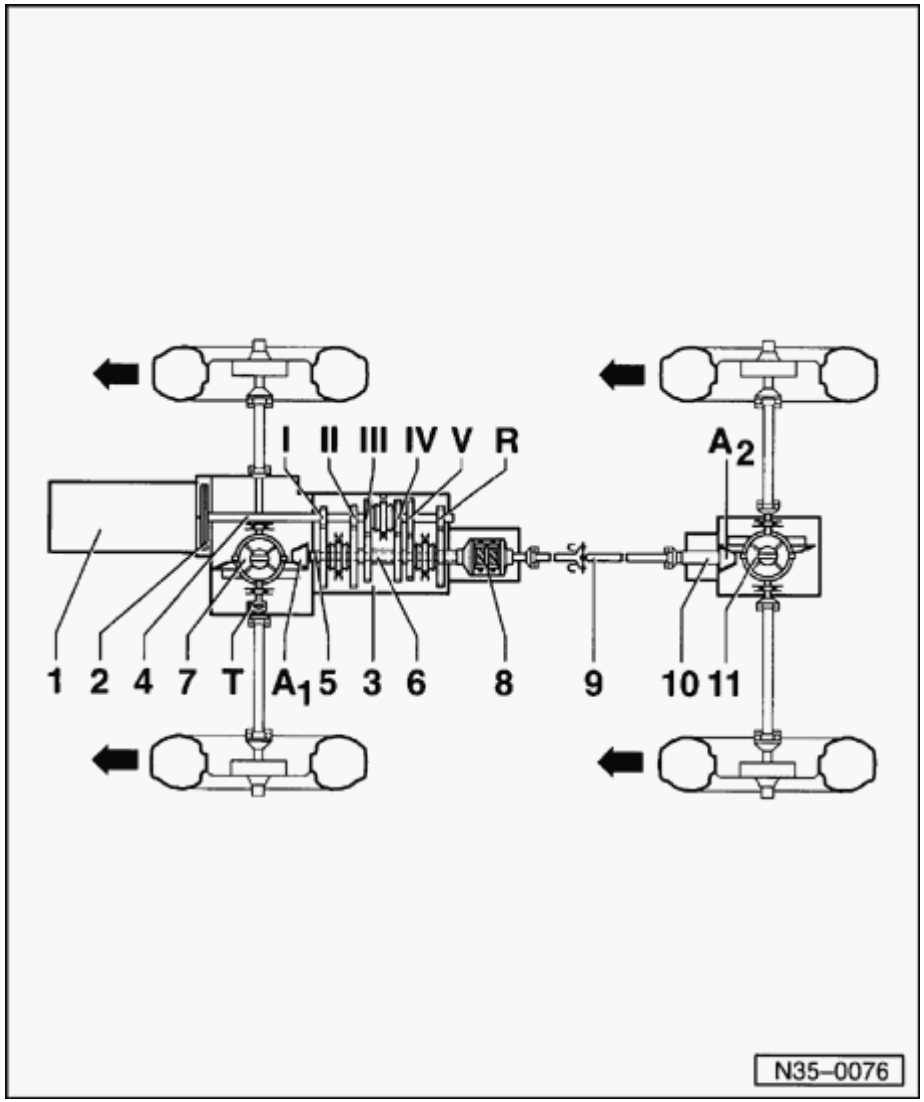
00-10



Transmission layout

1 - Engine
2 - Clutch
3 - Transmission
4 - Input shaft (main shaft)
5 - Front drive pinion (output shaft)
6 - Hollow shaft
7 - Front differential
8 - Torsen differential
9 - Driveshaft
10 - Rear drive pinion
11 - Rear differential

00-11



I - 1st gear

II - 2nd gear

III - 3rd gear

IV - 4th gear

V - 5th gear

R - Reverse gear

A1 - Front final drive

A2 - Rear final drive

T - Speedometer drive (electronic)

Note:

Arrows point in direction of travel.

00-11

Repair instructions

The maximum possible care and cleanliness and proper tools are essential to ensure satisfactory and successful transmission repairs. The usual basic safety precautions also, naturally apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Repair Manual, are summarized here. They apply to this Repair Manual.

Special tools

For a complete list of special tools used in this Repair Manual

⇒ *Special Tools Catalog*

Transmission

- When installing a replacement transmission or rear final drive, check oil level and top-up if necessary ⇒ Page 34-39 and ⇒ Page 39-80 .

- Vehicles with 2.7 ltr 195 kW engine: replacement transmissions contain an additional 0.3 ltr of oil for the lines of the

transmission oil cooling circuit. For this reason the transmission oil lines and oil cooler must be drained when fitting a replacement transmission.

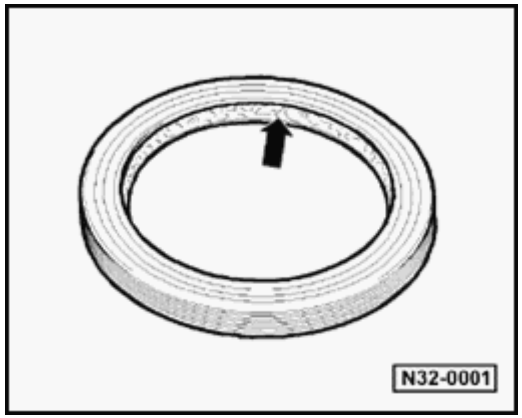
- Capacities and specifications from ⇒ Page 00-3 and ⇒ Page 00-6 .

00-12

- Thoroughly clean all connections and the surrounding area before disconnecting.
- When installing transmission, ensure dowel sleeves are correctly seated.

O-rings, seals, gaskets

- Always replace O-rings, seals and gaskets.
- After removing gaskets and seals, always inspect the contact surface on the housing or shaft for burrs resulting from removal or for other signs of damage.
- Thoroughly clean housing joint surfaces before assembling.



- Before installing radial shaft oil seals, lightly oil outer edge and fill space between sealing lips (arrow) with a thin coating of sealing grease G 052 128 A1.
- The open side of the oil seals faces toward the side with fluid filling.
- When replacing oil seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).
- Lightly oil O-rings before installing; this prevents the rings being crushed when inserting.
- Check oil level after replacing gaskets and oil seals ⇒ Page 34-39

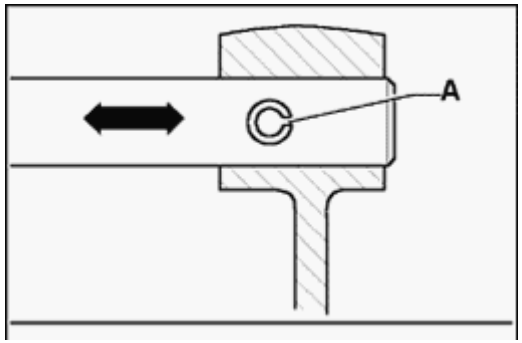
and ⇒ Page 39-80 .

Sealants

- Thoroughly clean housing joint surfaces before applying sealing paste.
- Apply sealing paste AMV 188 000 02 or AMV 188 001 02 evenly and not too thick.
- Breather holes must remain free of sealing paste.

Locking elements

- Do not overstretch circlips.
- Always replace circlips which have been damaged or over-tensioned.
- Circlips must be properly seated in the base of the groove.



- Replace spring pins. Position: slit -A- should be in line with the line of force (arrow).

Nuts, bolts

- Loosen nuts or bolts, opposite to tightening sequence.
- Tighten and loosen bolts and nuts for securing covers and housings in a diagonal sequence.
- Especially delicate parts, such as clutch pressure plates, must not be distorted. Loosen and tighten bolts and nuts in stages in a diagonal sequence.
- The tightening torques stated apply to non-oiled nuts and bolts.
- Replace self-locking bolts and nuts.
- The threads of bolts which are secured by a locking fluid should be cleaned with a wire brush. Then apply AMV 185 101 A1 when inserting.
- Threaded holes into which self-locking bolts or bolts coated with locking fluid are screwed, must be cleaned (e.g. tap). Otherwise there is a danger of bolts shearing when subsequently being removed.

Bearings

- Install needle bearings with the lettering on the bearing (the side with thicker metal) facing towards the drift or other tool used for installing.
- Mark needle bearings of 1st to 6th speed sliding gears when removing, this ensures that when installing, the same installation position can be guaranteed.
- Grease needle bearing for transmission input shaft in rear of flywheel.
- Lubricate all bearings in transmission housing with gear oil before installing.
- Heat inner races of tapered roller bearings to approx. 100 ° C before installing. Press in onto stop when installing so there is no axial clearance.
- Do not interchange the outer or inner races of bearings of the same size.
- Always replace the tapered roller bearings on one shaft together and use new bearings from a single manufacturer.

- The tapered roller bearings for the output shaft and the differential in the transmission are low-friction bearings. Do not additionally oil new tapered roller bearings when measuring friction torque. The bearings are pre-treated at the factory with a special type of oil for this purpose.

Shims

- Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- Check for burrs and damage.
- Only install perfect, undamaged shims.

Gears, synchro-hubs, inner races for sliding gears

- Heat gears and synchro-hubs to approx. 100 ° C before installing. Press in onto stop when installing so there is no axial clearance.
- Heat inner races for sliding gears to approx. 100 ° C when installing.
- The temperature can be checked with Temperature tester V.A.G 1558.
- Observe installation position.

Sliding gears

- After installing, check 1st to 6th speed sliding gears for axial clearance of 0.15-0.35 mm and check that they rotate freely.

Synchronizer rings

- Do not interchange synchronizer rings. When reusing always fit to the same gear.
- Check for wear, replace if necessary.
- Lubricate with gear oil before installing.

Clutch mechanism

- When removing transmission, remove clutch slave cylinder without disconnecting lines.
- If the slave cylinder is removed with the hydraulic line attached, do not depress clutch pedal. Otherwise the piston will be pressed out of the slave cylinder.
- Ensure that the pressure plate is kept straight: loosen and tighten bolts in a diagonal sequence and in several gradual stages.
- To reduce odor caused by a burnt clutch, thoroughly clean the clutch bellhousing, the flywheel and the parts of the engine facing the transmission.

- Vehicles with V6 2.7 ltr bi-turbo engine have an SAC pressure plate. On these vehicles an adjuster ring has to be reset (⇒ Page 30-42) when replacing the clutch plate on its own.

Calculations

Ratio i, calculating

Transmission ratio

Transmission ratio	=	No. of teeth driven gear	:	No. of teeth drive gear

Ratios			Formula
iG	=	gear ratio	ZG2 : ZG1
iA	=	axle ratio	ZA2 : ZA1
iov	=	overall ratio	iG x iA

Example:

	5th gear	Final drive
Drive gear	ZG1 = 37	ZA1 = 9
Driven gear	ZG2 = 31	ZA2 = 35

Calculations:

iG = 31 : 37 = 0.838

iA = 35 : 9 = 3.889

iov = (31 : 37) x (35 : 9) = 0.838 x 3.889 = 3.259

00-13

Vehicle speed V, calculating

V	**=**	**n : iov x UA x 0.06**
n	=	Engine speed (RPM)
iov	=	Overall ratio
UA	=	Dynamic rolling circumference of tires (m)
V	=	Vehicle speed (km/h)

Example:

V = 1000 : 3.100 x 1.93 x 0.06 = 37 km/h

At an engine speed of 1000 RPM, the vehicle road speed in 5th gear is 37 km/h.

General repair instructions

The maximum possible care, cleanliness and proper tools are essential to ensure satisfactory and successful transmission repairs. The usual basic safety precautions also apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair operations, which are otherwise mentioned at various points in the Repair Manual, are summarized here. They apply to this Repair Manual.

Special tools and equipment

For a complete list of special tools and equipment used in this Repair Manual ⇒ Special tools catalog

Transmission

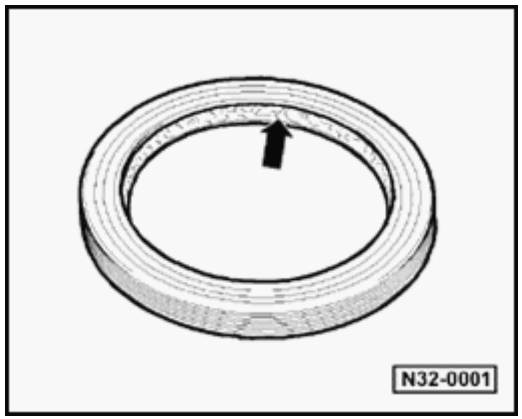
- After replacing the transmission or rear final drive, check oil level and top-up if necessary ⇒ Page 34-38 and ⇒ Page 39-84 .
- Capacities and specifications ⇒ Page 00-3 and ⇒ Page 00-9 .
- Thoroughly clean all connections and the surrounding area before disconnecting.

- When installing transmission, make sure dowel sleeves for aligning the engine and transmission are correctly seated.

00-15

O-rings, gaskets, seals

- Always replace O-rings, gaskets and seals.
- After removing gaskets and seals, always inspect the contact surfaces on the housing or shaft for burrs resulting from removal or for other signs of damage.
- Thoroughly clean housing joint surfaces before assembling.



- Before installing radial shaft seals, lightly oil outer edge and fill space between sealing lip and dust lip (arrow) with oil.
- The open side of the seals face toward the side containing the oil.
- When replacing seals, always vary the point at which the sealing lips make contact (use insertion depth tolerances).
- Lightly lubricate O-rings before installing, this prevents the rings from being pinched when inserting.
- Check oil level after replacing gaskets and seals ⇒ Page 34-38 or ⇒ Page 39-84 .

Sealants

- Thoroughly clean housing joint surfaces before applying sealing paste.

CAUTION!

- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

- Apply sealing paste AMV 188 200 03 or AMV 188 001 02 evenly and not too thick. Do not use sealing paste AMV 188 001 02 on a transmission with magnesium housing.

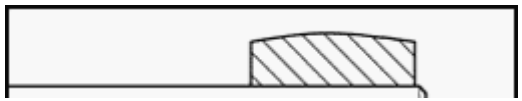
- Breather holes must remain free of sealing paste.

Circlips

- Always replace

- Do not over-stretch circlips.

- Circlips must be fully seated in the groove.



Roll pins

- Always replace roll pins.
- Installed position: slot is longitudinal to line of force (arrow).

Nuts, bolts

- Always replace self-locking nuts and bolts.
- Loosen nuts or bolts, opposite to tightening sequence.
- Tighten and loosen bolts and nuts for securing covers and housings in a diagonal sequence.
- Especially delicate parts, such as clutch pressure plates, must not be canted. Loosen and tighten bolts and nuts in stages in a diagonal sequence.
- The tightening torques stated apply to non-oiled nuts and bolts.
- The threads of bolts which are secured by a locking compound should be cleaned using a wire brush. Then apply AMV 185 101 A1 when installing.

CAUTION!

- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

- ***Threaded holes for self-locking bolts or bolts coated with locking fluid must be cleaned with tap. Otherwise there is a danger of bolts shearing when subsequently being removed.***

00-18

WARNING!

- ***Do not re-use any fasteners that are worn or deformed in normal use.***

- ***Some fasteners are designed to be used only once, and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual-replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.***

Bearings

- Install needle bearings with the lettering on the bearing (the side with thicker metal) facing the drift or other installation tool.
- Grease needle bearing for the input shaft in the crankshaft.
- Lubricate all bearings in transmission with gear oil before installing.
- Always replace tapered roller bearings on one shaft together and use new bearings from the same manufacturer.
- Heat tapered roller bearing inner races to approx. 100 ° C (212 ° F) before installing. Press in until stop is reached so there is no axial play.
- Do not interchange inner and outer bearing races with those from other bearings of the same size.
- The tapered roller bearings for the output shaft and the differential in the transmission are low-friction bearings. Do not additionally oil new tapered roller bearings when measuring friction torque. The bearings are pre-treated at the

factory with a special type of oil for this purpose.

Shims

- Use a micrometer to measure the shims at several points. Different tolerances make it possible to obtain the exact shim thickness required.
- Check for burrs and signs of damage.
- Only install shims that are in perfect condition.

Gears, synchro-hubs, inner races for sliding gears

- Heat gears and synchro-hubs to approx. 100 ° C (212 ° F) before installing. Press in until stop is reached so there is no axial play.
- Heat inner races for sliding gears to approx. 100 ° C (212 ° F) when installing.
- The temperature can be checked using VAG1558 temperature tester.
- Observe installation position.

Sliding gears

After assembling, check axial play of 1st to 5th sliding gears and reverse sliding gear (0.15-0.35 mm .006-.014 in.) and check for free movement.

Synchronizer rings

- Do not interchange.
- When re-using, install synchronizer rings with the same gear with which they were previously matched.
- Check for signs of wear; replace if necessary.
- Lubricate with gear oil before installing.

Clutch mechanism

- When removing transmission, remove clutch slave cylinder without opening hydraulic lines.

CAUTION!

Do not depress the clutch pedal after removing the slave cylinder. Otherwise the piston will be pressed out of the slave cylinder.

- Do not cant clutch pressure plate, loosen and tighten in a diagonal sequence and in stages.
- To reduce odor caused by a burnt clutch, thoroughly clean the bellhousing, flywheel and

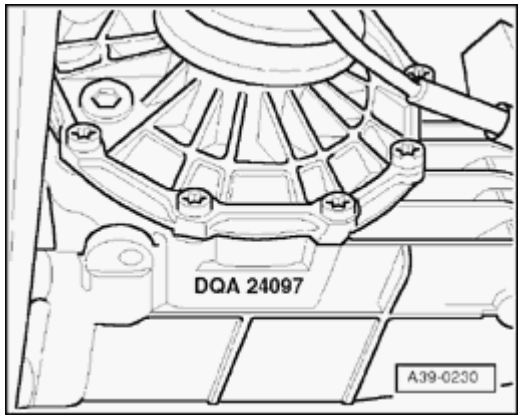
the side of the engine facing the transmission.

00-20

Rear final drive, identification

Final drive 01H is allocated to the all wheel drive automatic transmission 01V.

Allocation ⇒ page 00-21 , technical data.



Code letters and date of manufacture of rear final drive.

Example:	DQA	24	09	7
	I	I	I	I
	I	I	I	I
	Code letters	Day	Month	Year (1997) of manufacture

The code letters of the rear final drive are also listed on the vehicle data plates.

Code letters, allocation, ratios

Rear final drive			01H.A	01H.B
Final drive	Code letters		DXT	DAK
	Application	from	01.99	10.95
		to	-	-
Ratio	Final drive	Z2:Z1 = i	35:9 = 3.889	37:9 = 4.111
Drive axle	Flange ∅ mm		108	100
Allocation: **Automatic transmission 01V all road**	Code letters		EDF, EMP, FAQ, FHJ	DKB, DTV, EFQ, DRN, ECG, FAL, EKD, FAS, FHH

Capacity

Planet gear

Capacity	Planet gear	Automatic transmission
New filling	9.0 L	01V
Change	approx. 2.6 L	
Lubricant	ATF	

ATF is available as a replacement part (is also referred to as VW ATF).

Container size 0.5 L -part number G 052 162 A1

Container size 1.0 L -part number G 052 162 A2

Only ATF available as a replacement part must be used in the planetary gear of the automatic transmission 01V.

Final drive-front

Capacity	Final drive	Automatic transmission
New filling	0.82 L	01V
Change	Filled for life, no replacement	
Lubricant	Gear oil SAE75 W90 (synthetic-oil)	

Gear oil SAE 75 W90 (synthetic oil) is available as a replacement part.

Container size 0.5 L -part number G 052 145 A1

Container size 1.0 L -part number G 052 145 S2

Center differential

Capacity	Center differential	Automatic transmission
New filling	0.8 L	01V
Change	Filled for life, no replacement	
Lubricant	Gear oil SAE75 W90 (synthetic-oil)	

Gear oil SAE 75 W90 (synthetic oil) is available as a replacement part.

Container size 0.5 L -part number G 052 145 A1

Container size 1.0 L -part number G 052 145 S2

Rear final drive

Capacity	Final drive	Rear final drive
New filling	1.9 L	01H
Change	Filled for life, no replacement	
Lubricant	Gear oil SAE75 W90 (synthetic-oil)	

Gear oil SAE 75 W90 (synthetic oil) is available as a replacement part.

Container size 0.5 L -part number G 052 145 A1

Container size 1.0 L -part number G 052 145 S2

Roll starting and towing, notes

WARNING!

When towing the vehicle, selector lever must be in position N and the vehicle must not be towed for more than 50 km and no faster than 50 km/h, otherwise the transmission will be damaged.

Note:

Roll starting the engine is not possible (e.g. if the battery is too weak or the starter does not work).

Servicing, notes

The maximum possible care, cleanliness and proper tools are essential to ensure satisfactory and successful transmission repairs. The usual basic safety precautions also apply when carrying out vehicle repairs.

A number of generally applicable instructions for individual repair procedures, which are otherwise mentioned at various points in the Repair Manual, are summarized here. They apply to this Repair Manual. They apply to this Repair Manual.

Special tools and equipment

For a complete list of special tools used in this repair manual: see "Special tools and equipment" or "Special tools".

Transmission

- Rules of cleanliness for working on automatic transmissions ⇒ page 37-148 .
- Do not run engine with the oil pan removed or without ATF filling and do not tow vehicle.
- Secure torque converter on removed transmission to keep it from falling out.

- Thoroughly clean all connections and the surrounding area before disconnecting.

- Check installation dimension of torque converter before installing transmission ⇒ page 32-8

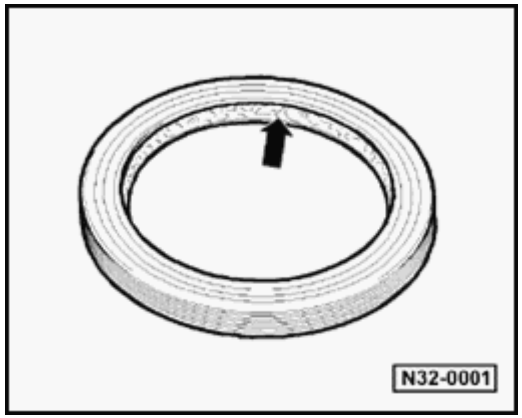
- When installing transmission, make sure centering sleeves are correctly seated.
- Place parts that have been removed on a clean surface and cover. Use foils and paper. Use lint-free cloths only!
- Carefully cover over opened components or seal, if repairs are not carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation.
- Check, and if necessary correct amount of the following fluids when replacing the automatic transmission. ATF in planetary gear ⇒ page 37-133 , Gear oil in front final drive ⇒ page 39-1 , Transmission oil in center differential ⇒ page 39-40 . Capacities and specifications ⇒ page 00-22 onward.
- When replacing the rear final drive, check and if necessary, correct oil level in rear final drive ⇒ page 39-94 Capacities and specifications ⇒ page 00-23 .

O-rings, gaskets, seals

- Always replace O-rings, gaskets and sealing rings.

- After removing gaskets and seals, always inspect the contact surfaces at housing or shaft for burrs resulting from removal or for other signs of damage.

- Thoroughly clean housing joint surfaces before assembling and apply sealing compound AMV 188 200 03.



- Before installing, fill gap between sealing lips (arrow) of radial-shaft seals half way with sealing grease 052 128 A1.
- The open side of the seals face toward the fluid to be sealed in.
- For installation, lightly coat outer circumference and sealing lip with ATF or transmission oil, depending on the installation location.
- Lightly lubricate O-rings before installing, this prevents the rings from being pinched when inserting.
- Use only ATF in areas near ATF. Other lubricating substances cause functional problems in the hydraulic transmission control.
- When pressing in new seals, make sure the sealing lip does not run on the same point as the sealing lip of the old seal (use insertion depth tolerances).
- After installing, check and if necessary correct fluid levels in the affected area. ATF in planetary gear ⇒ page 37-133 , Gear oil in front final drive ⇒ page 39-1 , Transmission oil in center differential ⇒ page 39-40 , Transmission oil in rear final drive ⇒ page 39-94 . Capacities and specifications ⇒ page 00-22 onward.

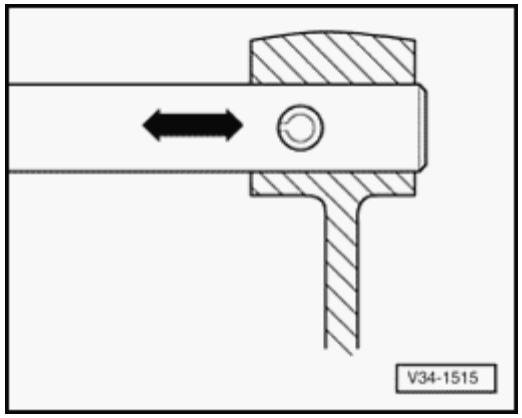
00-30

Nuts, bolts

- Loosen bolts in reverse order of tightening sequence.
- Tighten and loosen bolts or nuts for securing covers and housings without tightening sequence in diagonal sequence in stages.
- Do not cant, and loosen and tighten especially sensitive parts - e.g. valve body - in diagonal manner in stages.
- The tightening torques stated apply to non-oiled nuts and bolts.
- Always replace self-locking nuts and bolts.
- Using a wire brush, clean threads of bolts which are secured with locking compound. Next, insert bolts using AMV 185 101 A1.
- Threaded holes into which self-locking bolts or bolts with locking compound are threaded in, must be cleaned (e.g. using threaded tap). Otherwise there is danger that the bolts may shear when removed again.

Circlips

- Do not over-stretch circlips.
- Always replace damaged or over-stretched circlips.
- Circlips must be fully seated in grooves.



- Replace roll pins. Installation position: Slot is longitudinal to line of force.

Mounts

- Install needle bearings with the lettering on the bearing (the side with thicker metal) facing the drift.
- Insert bearing with transmission oil or ATF, depending on installation location.
- Tapered roller bearings for output shaft and differential in rear final drive are low-friction bearings. Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory for this reason.
- Do not interchange inner and outer bearing races with those from other bearings of the same size.
- Tapered roller bearings are allocated to the date of transmission manufacture and code letters in the parts catalog.
- Always replace tapered roller bearings on one shaft together and use new bearings from the same manufacturer.

- Heat tapered roller bearing inner races to approx. 100 5C before installing. Press in to stop so that there is no axial play.

Shims

- Measure shims at several points using a micrometer. Different tolerances make it possible to measure the required shim size exactly.

- Check for burrs and signs of damage. Only install perfect adjustment shims.

- Only install perfect undamaged adjustment shims.

00-32

Valve body

- Replace valve body if shift members are burnt.

- The valve body is allocated to the transmission code letters ⇒ parts catalog.

Guided Troubleshooting, Vehicle On Board Diagnostic (OBD) and Test Instruments

- Before performing repairs on the automatic transmission, the malfunction cause must be determined as precisely as possible via the VAS5051 Tester in operating modes "Guided Troubleshooting", "Vehicle Self-Diagnosis" and "Test Instruments."

On Board Diagnostic (OBD) is described in:

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01, Performing On Board Diagnostic (OBD)*

01-1

On Board Diagnostic (OBD), function

The automatic transmission is controlled electro-hydraulically.

The automatic Transmission Control Module (TMC) -J217- receives information from components that effect the selection of gears. It passes the information on to solenoid valves that control the solenoid valves in the valve body. The solenoid valves convey the fluid pressure generated by the ATF pump to the appropriate clutches and brakes to be engaged.

Transmission Control Module (TMC) -J217- malfunction recognition

The term "On Board Diagnostic (OBD)" applies specifically to the electronic/electric control.

The control module is equipped with a Diagnostic Trouble Code (DTC) memory so in the event of an electronic/electrical component failure or on open circuit, the malfunction can be determined quickly. Malfunctions are recognized by electrical signals and stored in the DTC memory together with an indication of the type of malfunction and malfunction location.

The control module recognizes malfunctions during vehicle operation and stores them in a DTC memory. This information will remain

available even if the system voltage fails.

The control module distinguishes between permanent malfunctions that have occurred and sporadic malfunctions.

01-2

If a malfunction is no longer present after a certain time or a long drive, it will be converted to a sporadic (SP) DTC.

A malfunction will also be converted to sporadic when the DTC memory is not erased after repairs.

Malfunctions which are stored in the memory as sporadic malfunctions, will be displayed as "sporadic DTCs" when checked by the scan tool V.A.G 1551. In such cases "SP" appears on the right of the display. If the printer is switched on, the print-out will show "sporadic DTC" after the identification of the malfunction.

If the sporadic DTC does not occur again after 40 cold engine starts and subsequent transmission warm-up, the malfunction in DTC memory will be automatically erased.

The possibilities offered by On Board Diagnostic can only be used with the Vehicle Diagnostic, Testing and Information System VAS 5051 or the V.A.G 1551 scan tool (mode 1, rapid data transfer).

Available functions of Vehicle Diagnostic, Testing and Information System VAS 5051 or the V.A.G1551 scan tool ⇒ page 01-42 .

01-3

Security functions of the Transmission Control Module (TCM)

When one or more components or sensors fail, the Transmission Control Module (TCM) -J217- activates the appropriate alternate functions or emergency programs. This ensures destruction-free operation of the automatic transmission with some effect on the function and quality of shifting.

When critical malfunctions occur with an active TCM, the current selected gear will be held. "Mechanical emergency running mode with the control module active" is activated by the TCM as soon as the driving situation regarding transmission security and engine security permits it.

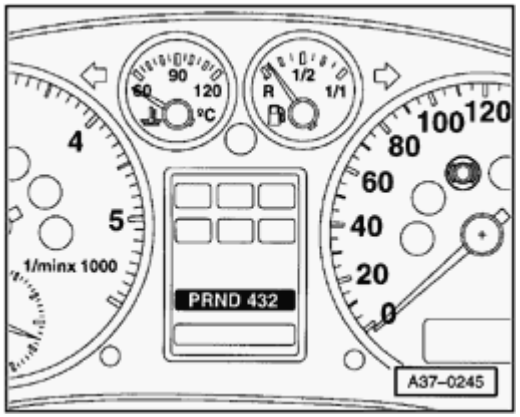
Mechanical backup with active control module

- The transmission shifts out of all forward gears into hydraulic 4th gear. The torque converter clutch is unlocked (not applied). All solenoid valves are de-energized.

- Maximum shift pressure is applied to the power-transmitting elements.

- Reverse gear can be engaged. The shift lock

solenoid is active (in "P" and "N").



- All segments of the transmission range selector lever display light up.

01-4

- The Multi-function Indicator Light (MIL) lights up after 2 driving cycles (Dcy); check DTC memory (⇒ page 01-43 and compare with DTC table ⇒ page 01-45).

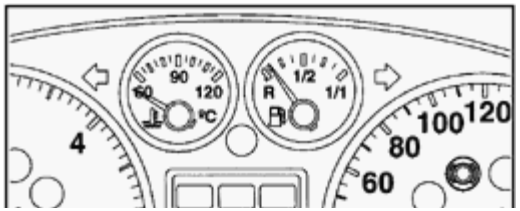
If the TCM -J217- malfunctions (e.g. if the power supply is faulty or the connector becomes disconnected), the transmission will immediately switch to "mechanical back-up mode with inactive control module" and continue to operate.

Mechanical backup with non-active control module

- The transmission shifts out of all forward gears into hydraulic 4th gear. The torque converter clutch is unlocked (not applied). All solenoid valves are de-energized.

- Maximum shift pressure is applied to the power-transmitting elements.

- Reverse gear can be engaged. The shift lock solenoid is active (in "P" and "N").



- All of the segments transmission range selector lever display are dark.
- The MIL lights up when the Engine Control Module (ECM) has recognized a CAN-bus malfunction (missing data exchange between engine and transmission control modules) (after 2 Dcy); check DTC

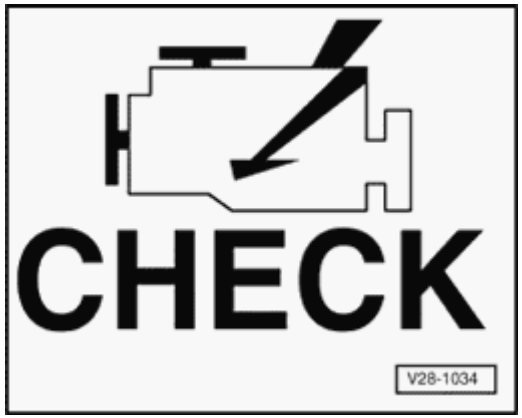
memory of the control module.

- Transmission Control Module (TCM) -J217- does not function at all, i.e. it cannot be checked via On Board Diagnostic (OBD).

01-5

Malfunction Indicator Lamp (MIL) function, checking

If emissions malfunctions are recognized by the TCM, the Malfunction Indicator Lamp (MIL) will be switched on.



Location of the MIL: integrated in speedometer in instrument cluster

Notes:

When the MIL is switched on, it will either blink or light continuously. The DTC memory for the TCM must be checked ⇒ page 01-43 .

- *MIL flashing: there is a malfunction that could damage the Three Way Catalytic Converter (TWC). In this case, drive only with reduced power.*
- *MIL continuously on: there is a malfunction that degrades emissions. Check DTC memory of the Engine Control Module (ECM) or the TCM.*
- *If there are driveability problems (e.g. a customer complaint) and the MIL is not on, perform the MIL functional because malfunctions can be stored that do not switch the MIL on.*

01-6

MIL functional check

- Switch ignition on: MIL must come on.

  If the MIL does not come on when the ignition is switched on (with the engine not running): Check DTC memory ⇒ page 01-43 . If necessary, check wiring per wiring diagram or replace light bulb.

- Start engine and let idle: MIL must switch off after several seconds.

  If the MIL does not switch off after the engine is started: Check DTC memory ⇒ page 01-43 .

01-7

Conditions for recognition of a driving cycle (Dcy)

A driving cycle (Dcy) is complete when the ignition is switched on one time, the engine starts, the engine start is recognized by the control module, and the ignition is switched off.

01-8

On Board Diagnostic (OBD), technical data

Memory	
♦ Permanent memory	yes
Data output	
Rapid data transfer	yes
Blink code output	no
Output Diagnostic Test Mode	yes
Basic setting	no
Coding control module	yes
Read measuring value block	yes

Electrical/electronic component locations ⇒ **Page 01-11**

01-9

On Board Diagnostic II (OBD II), functions

Note:

The following modes can be selected via address word 33:

Mode	Function
1	Transmit diagnostic data: ♦ Only certain individual test values can be read. Read the the measuring value block by using address word 02, function 08.
2	Not applicable
3	Check DTC memory: ♦ Only emissions-influencing malfunctions are indicated immediately or after two driving cycles (Dcy), depending on the malfunction, via the corresponding P-codes. Check DTC memory by using address word 02, function 02.
4	Erase DTC memory: ♦ DTC memory can be erased, even if it has not previously been read. Erase DTC memory by using address word 02, function 05.
5	Not applicable
6	Not applicable
7	OBD test results, continuously monitored: ♦ Emissions-related malfunctions can be read, even if these malfunctions have not existed long enough for the MIL to be switched on.

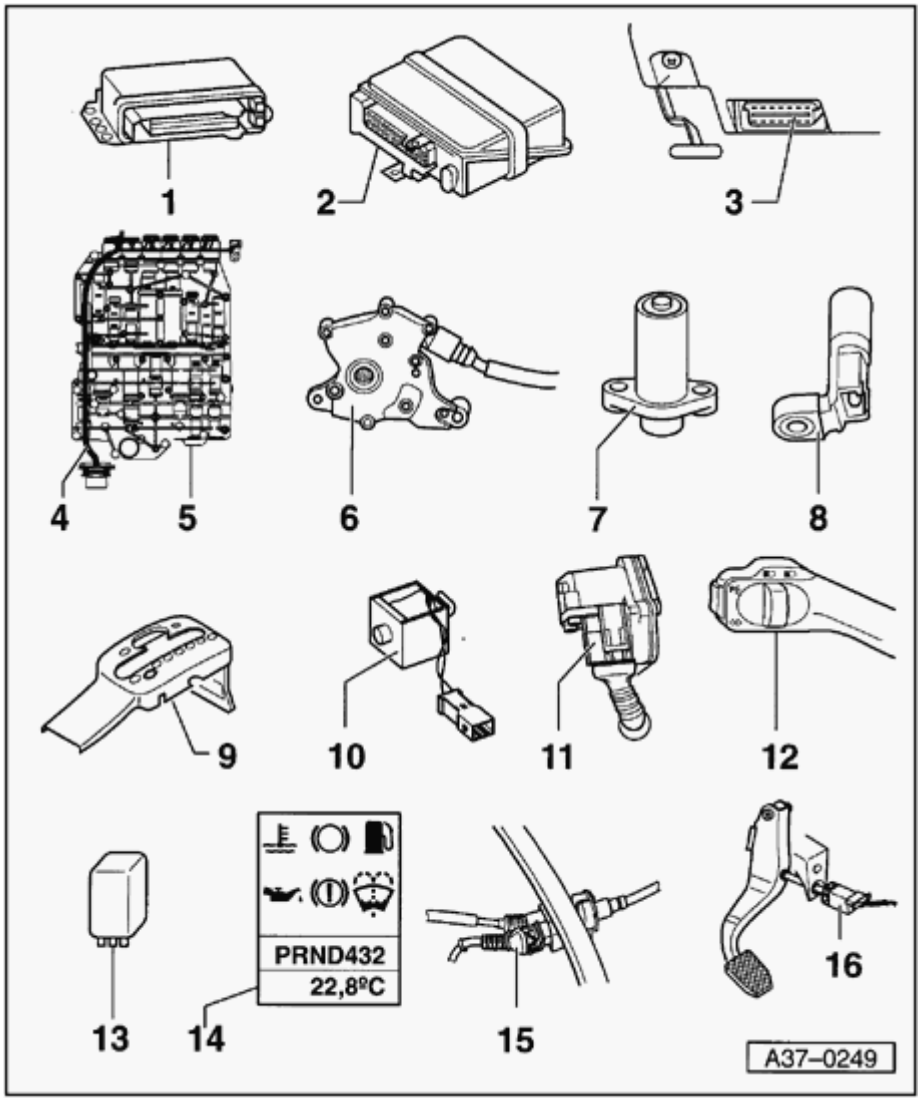
01-10

Mode	Function
8	• Not applicable
9	This mode only applies as of model year 2000. • The first value indicates the Part No. and the program or data status of the Transmission Control Module (TCM). • The second value indicates a checking summation, for instance A357. This value is calculated internally and can be disregarded.

Note:

There is no further detailed information about OBD in this section.

01-11



Electrical/electronic components and locations

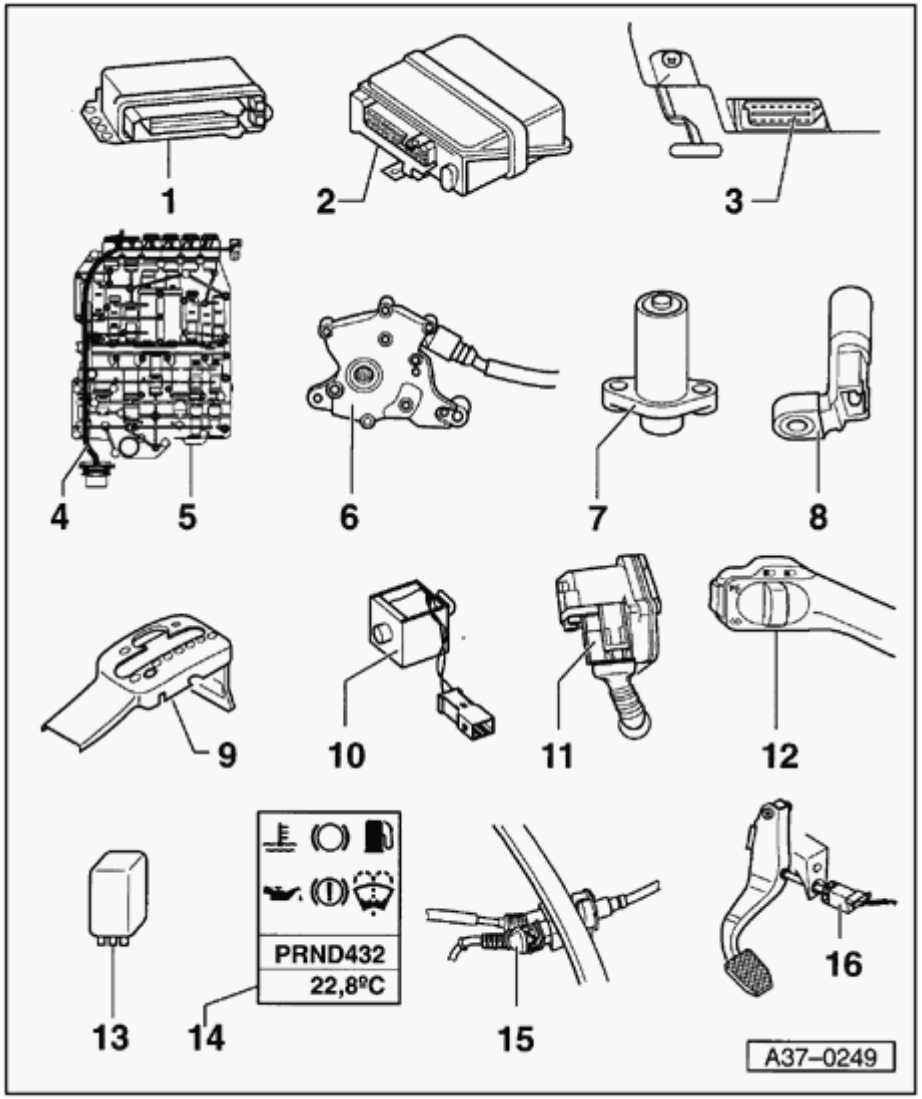
1 - Automatic Transmission Control Module (TCM) -J217-

- Location ⇒ Fig. 1 , ⇒ Page 01-20
- Removing ⇒ Fig. 2 , ⇒ Page 01-21
- Installing ⇒ Fig. 3 , ⇒ Page 01-22
- Control modules are checked via On Board Diagnostic (OBD) ⇒ Page 01-34 Initiating On Board Diagnostic (OBD)

2 - Engine Control Module (ECM)

- Location ⇒ Fig. 4 , ⇒ Page 01-23
- Control modules are checked via On Board Diagnostic (OBD) ⇒ Page 01-34 Initiating On Board Diagnostic (OBD)

01-12



3 - Data Link Connector (DLC)

- Location ⇒ page 01-24 , ⇒ Fig. 5

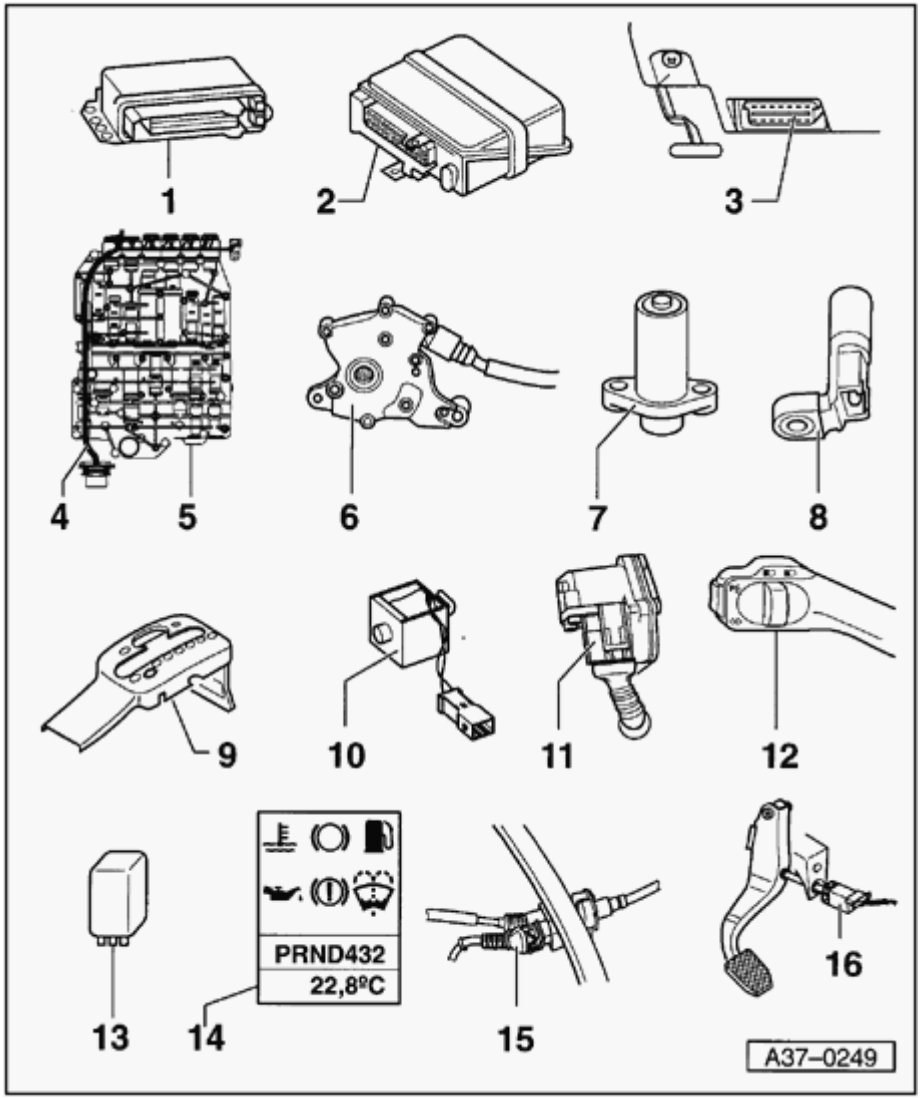
4 - Conductor strip with Transmission Fluid Temperature (ATF) Sensor -G93-

- Location ⇒ page 01-26 , ⇒ Fig. 7
- -G93- is checked via On Board Diagnostic (OBD)

5 - Valve body

- Location ⇒ page 01-25 , ⇒ Fig. 6
- The solenoid valves -N88-, -N89-, -N90-, -N91-, -N92-, -N93- and -N94- are attached to the valve body
- Components are checked via OBD

01-13

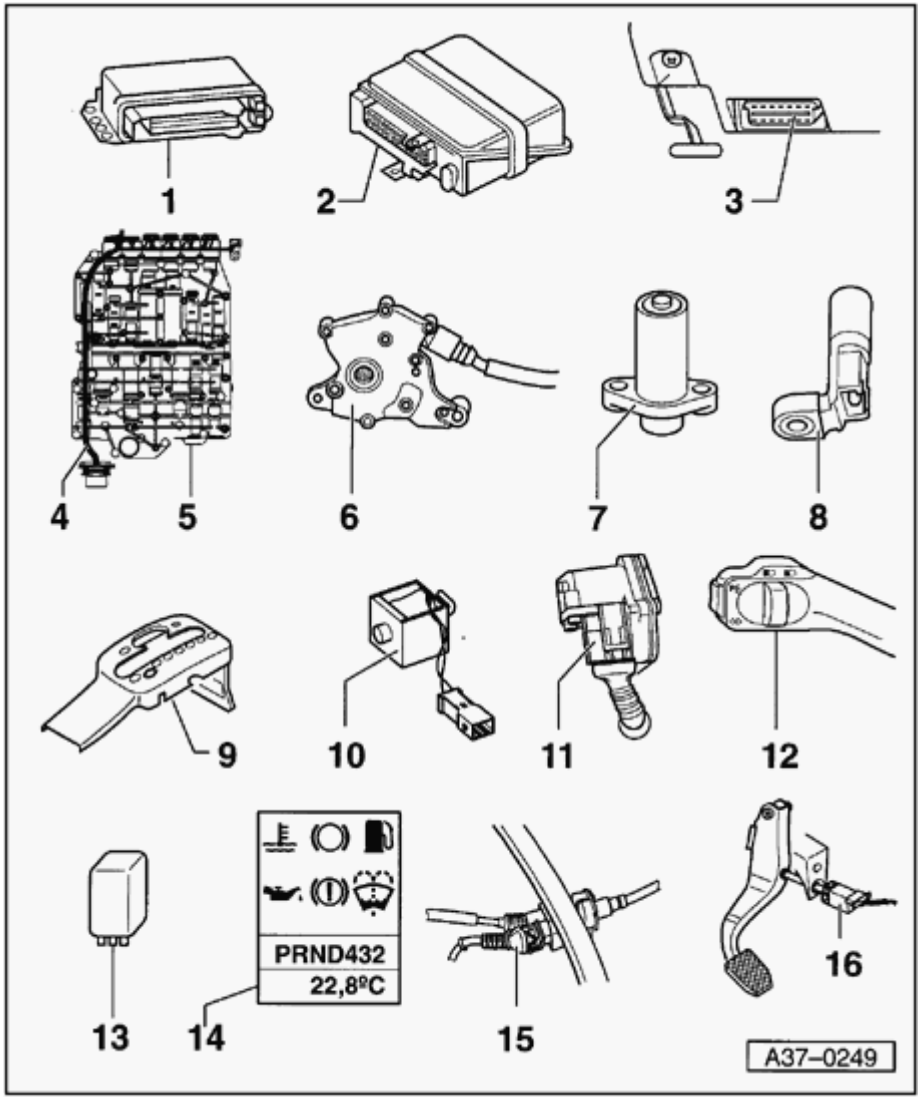


6 - Multi-function Transmission Range (TR) switch -F125-

- Location, removing and installing ⇒ page 01-27 , ⇒ Fig. 8
- Checked via On Board Diagnostic (OBD)

7 - Sensor for Transmission RPM -G182-

- Location, removing and installing ⇒ page 01-29 , ⇒ Fig. 11
- Checked via OBD



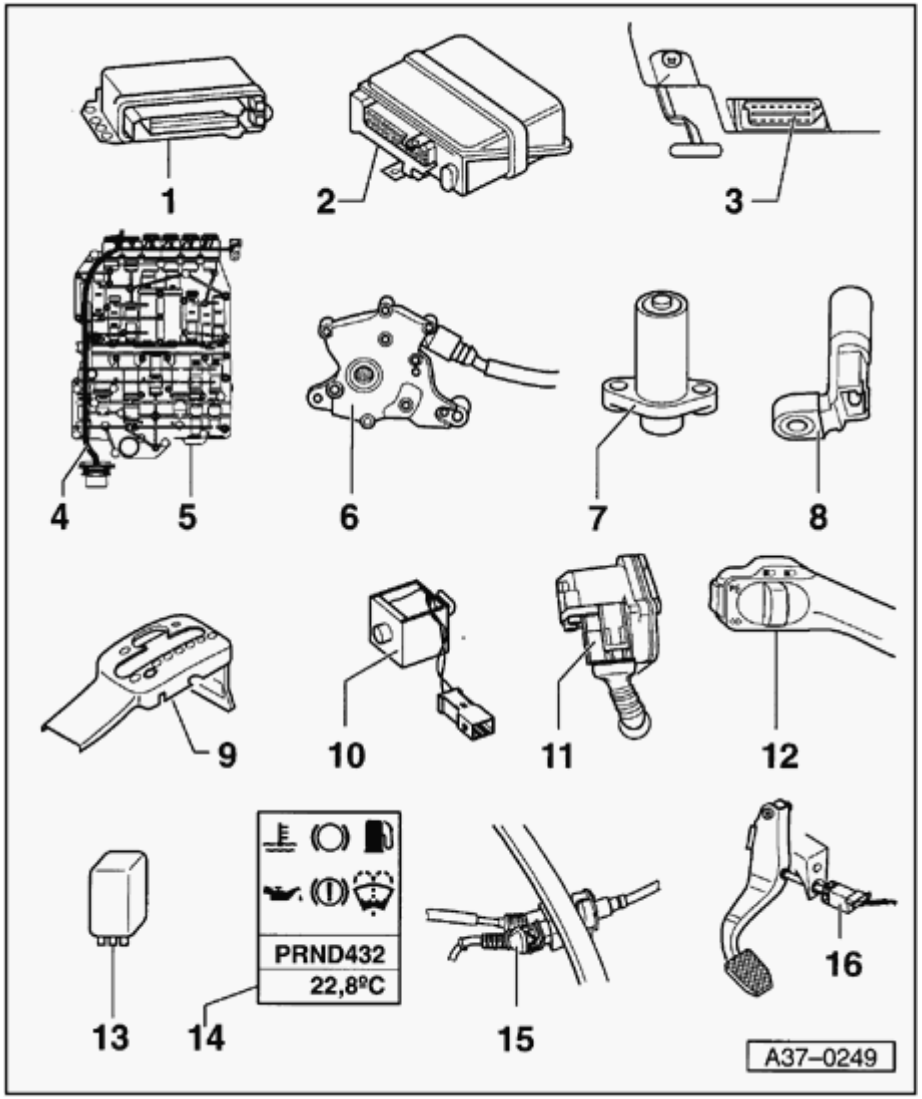
8 - Transmission Vehicle Speed Sensor (VSS) -G38- (also referred to as Sensor for Transmission Output RPM -G195-)

- Location, removing and installing ⇒ page 01-28 , ⇒ Fig. 10
- Checked via On Board Diagnostic (OBD)
- Records the transmission output speed

9 - Tiptronic switch -F189-

- Location, removing and installing ⇒ page 01-27 , ⇒ Fig. 9
- The switch can be checked in, read measured value block ⇒ page 01-186 and in the electrical check ⇒ page 01-273

01-15



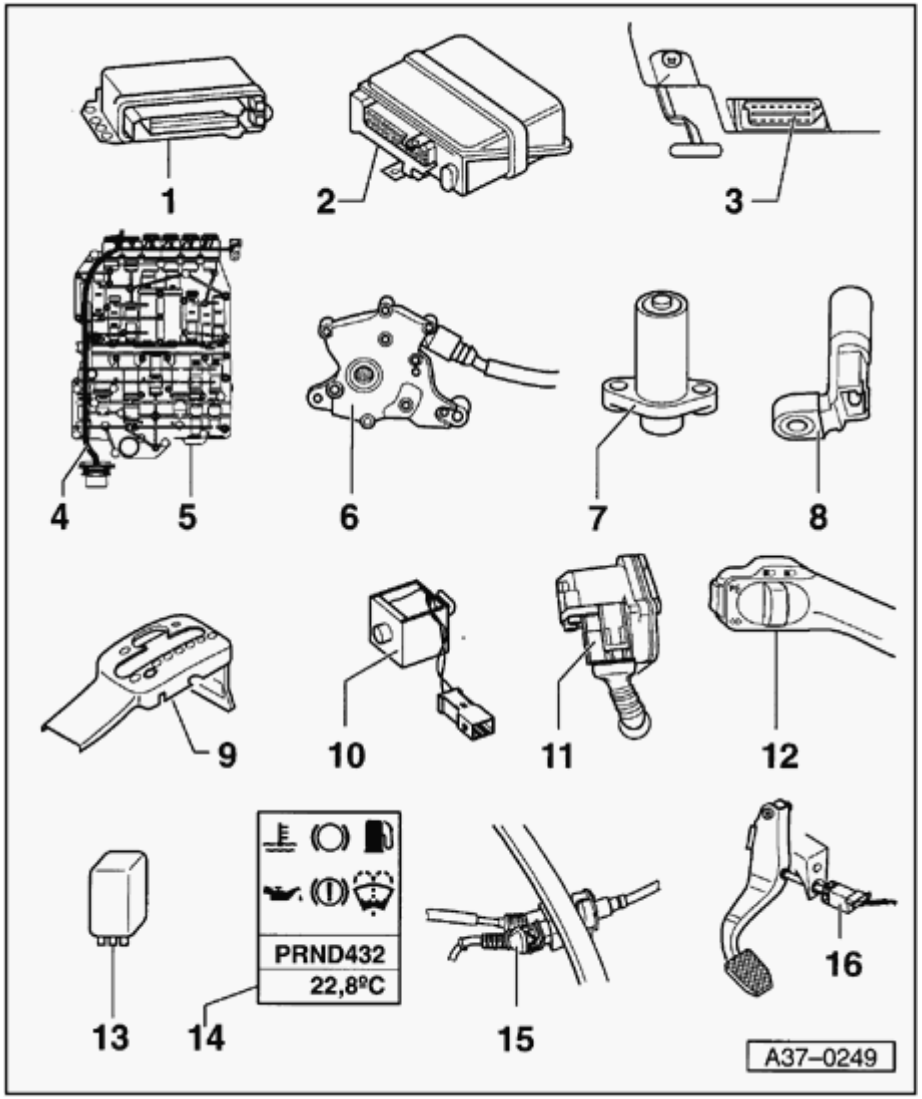
10 - Shift lock solenoid -N110-

- Location ⇒ page 01-30 , ⇒ Fig. 12
- Removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

- Can be checked electrically ⇒ page 01-273 and via reading measured value block ⇒ page 01-186

01-16

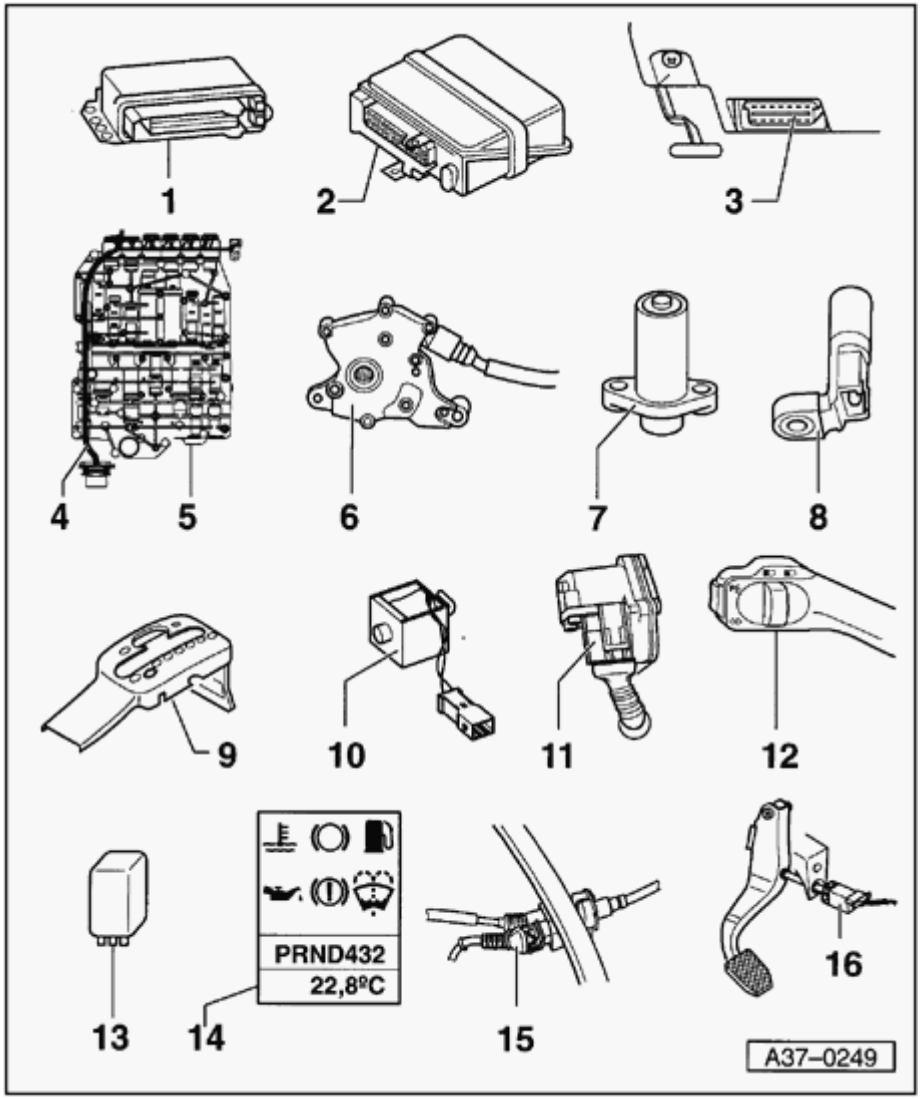


11 - Throttle Position (TP) sensor -G69-

- Location ⇒ page 01-30 , ⇒ Fig. 13
- The TP sensor signal will be checked via On Board Diagnostic (OBD)
- The TP sensor signal is transmitted to the transmission control module via the engine control module. The signal can only be checked in measured value block ⇒ Page 01-186 . If OBD indicates a malfunction in the TP sensor, perform OBD for the Engine Control Module.

⇒ *Repair Manual, Fuel Injection & Ignition, Repair Group 01*

01-17



12 - Cruise control switch -E45-

- Location: The cruise control switch is on the steering column
- Removing and installing:

⇒ *Repair Manual, Repair Manual, Electrical Equipment, Repair Group 94*

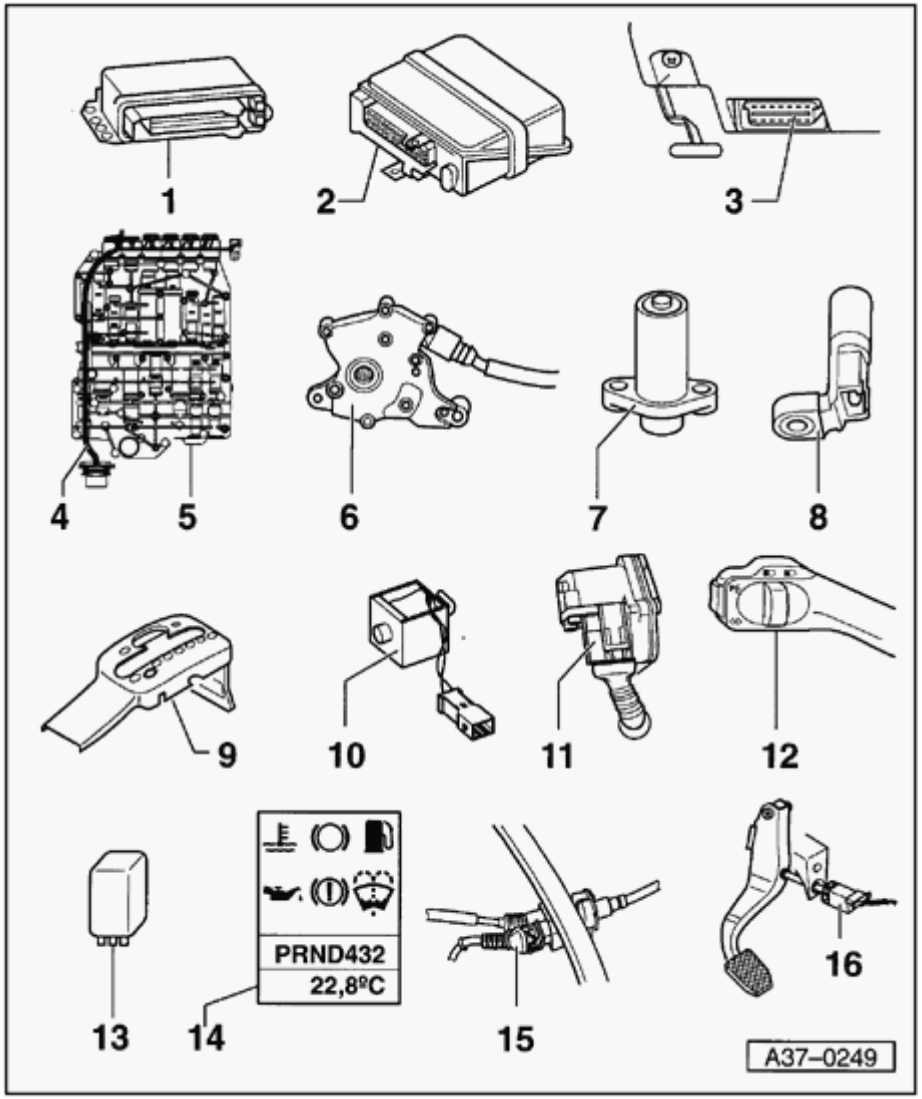
- Can be checked during electrical test ⇒ page 01-273

13 - Starting interlock relay -J207-

- Location ⇒ page 01-31 , ⇒ Fig. 14

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

01-18



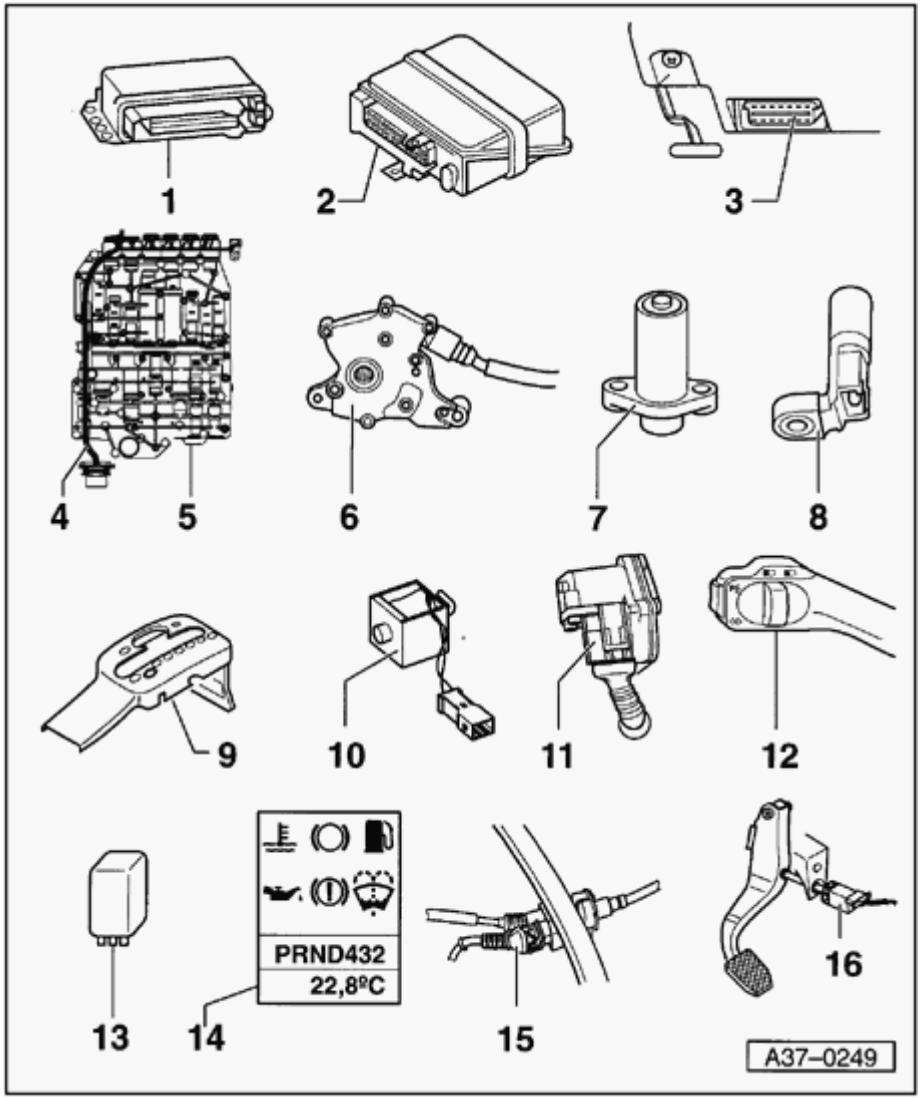
14 - Transmission Range (TR) Selector Lever Display -Y6-

- Location ⇒ page 01-31 , ⇒ Fig. 15
- When the TR Selector Lever Display does not light up, it indicates that the transmission is in emergency running mode with the Transmission Control Module (TCM) inactive.
- All segments of the TR Selector Lever Display light up, it indicates that the transmission is in emergency running mode with the TCM active.

15 - Kick down switch -F8-

- Location ⇒ page 01-32 , ⇒ Fig. 16
- Can be checked electrically ⇒ page 01-273 and via reading measured value block ⇒ page 01-186

01-19



16 - Brake Light Switch -F-

- Location: ⇒ page 01-33 , ⇒ Fig. 17
- Removing and installing

⇒ *Repair Manual, Brake System, Repair Group 46*

- Can be checked electrically ⇒ page 01-273 and via reading measured value block ⇒ page 01-186

01-20

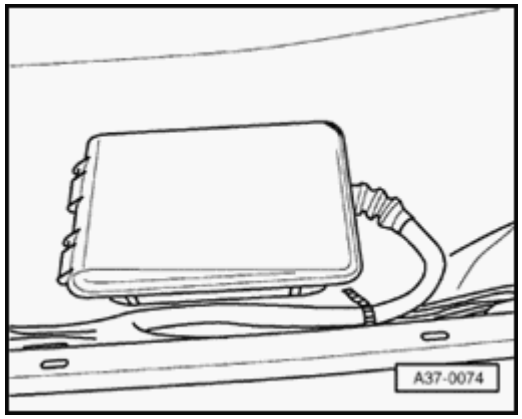


Fig. 1 Location of automatic Transmission Control Module (TCM) -J217-

The control module is located in front of the right front seat under the carpet in the foot well.

01-21

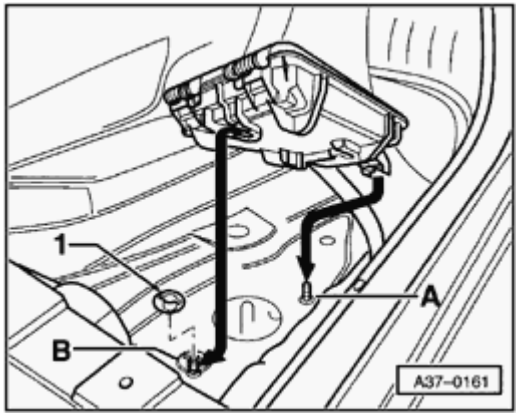


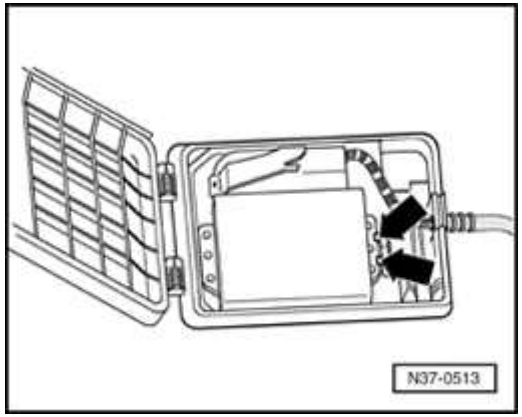
Fig. 2 Automatic Transmission Control Module (TCM) -J217-, removing and installing

Removing

- Remove lower right A-pillar trim and right front door sill trim.

⇒ *Repair Manual, Body-Interior, Repair Group 70*

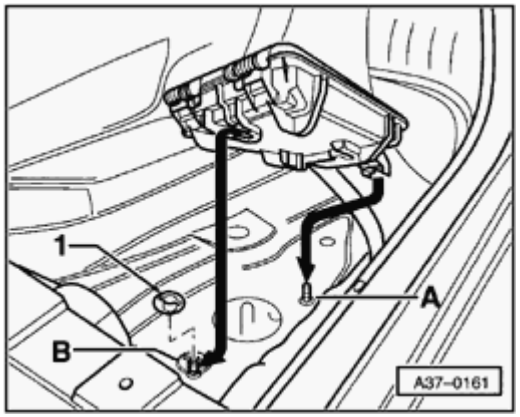
- Detach carpeting from right inside door sill, and raise carpeting approx. 20 cm.
- Unclip box at -A- by pulling it upward.
- Unclip box at -B- as shown.



- Unclip TCM from box (arrows).
- Release catch on multi-pin connector and disconnect connector from TCM ⇒ Fig. 3

Installing:

Install in reverse order of removal, with the following additional steps:



- Check that clip nut -1- is properly secured.

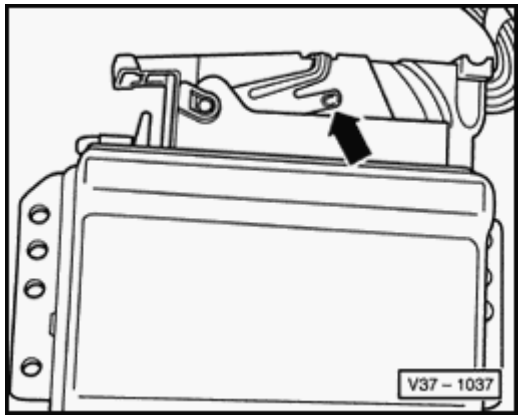


Fig. 3 TCM -J217-, disconnecting

- Switch ignition off and wait approx. 30 seconds.
- Release connector by pressing catch in direction of arrow.

Connect in reverse order of disconnecting.

01-23

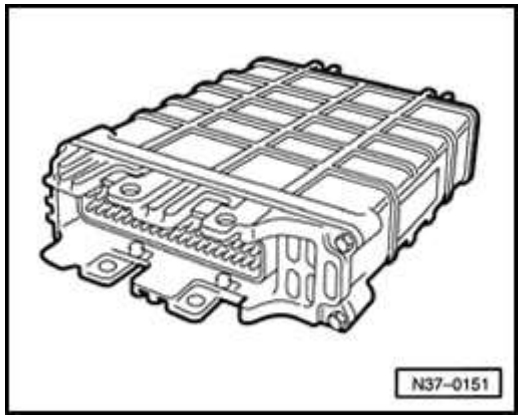


Fig. 4 Engine Control Module (ECM)

Location: in electronics box (E-box) in plenum chamber (left side).

ECM, removing and installing

⇒ *Repair Manual, Fuel Injection & Ignition, Engine, Groups 01, 23 or 24*

01-24

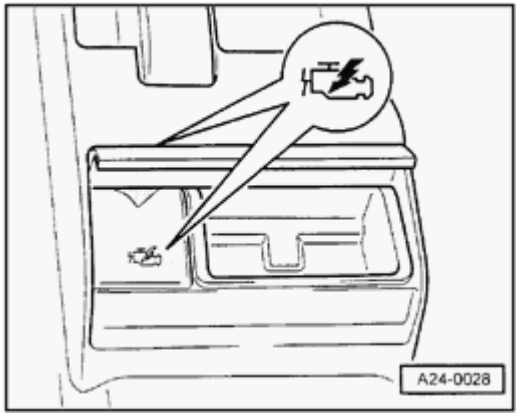
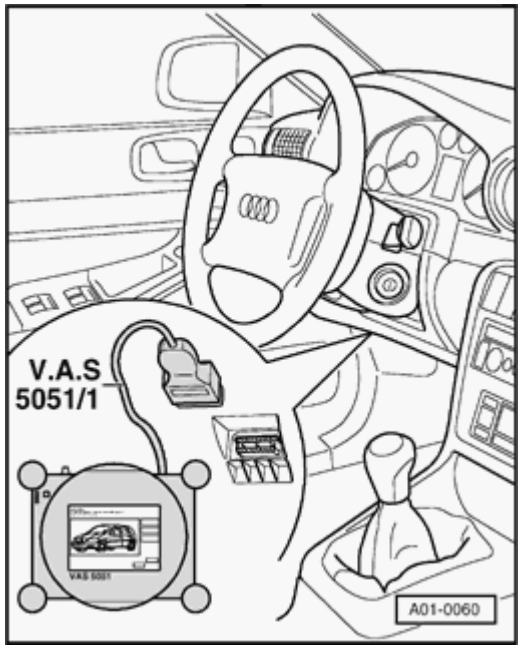


Fig. 5 Data Link Connector (DLC)

Location: Up to m. y. 2000, the Data Link Connector (DLC) is located under the rear ashtray (center console).



As of m. y. 2001, the DLC is located under the kneebar left of the steering wheel.

- Connect VAS 5051 tester with VAS5051/1 diagnostic wire, or connect V.A.G 1551 Scan Tool with VAG 1551/3 adapter.
- Enter address word "02 transmission electronics" and continue switching until "selecting function XX" appears on display ⇒ page 01-36 .

01-25

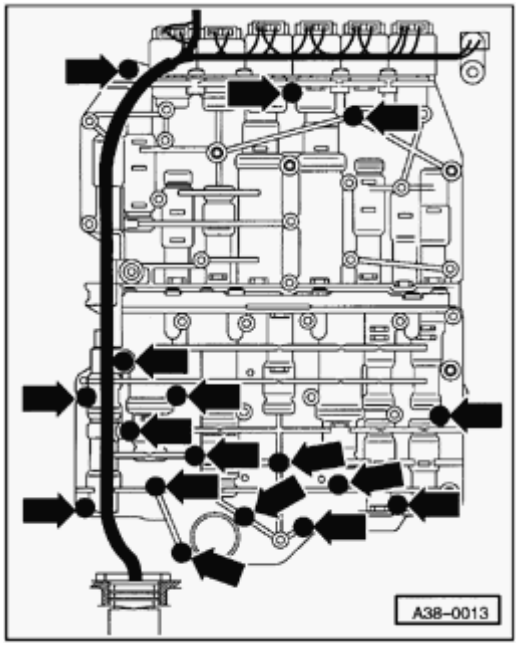


Fig. 6 Valve body

Location: The valve body is bolted to the underside of the transmission housing inside the oil pan.

The Solenoid Valves -N88-, -N89-, -N90-, -N91-, -N92-, -N93- and -N94- are attached to the valve body. The solenoid valves -N91-, -N92-, -N93- and -N94- are also referred to as pressure control valves 1 (-N215-), 2 (-N216-), 3 (-N217-) and 4 (-N218-).

Removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

There are two types of transmissions:

- For transmissions with hydraulic regulation -E17-, the transmission input speed sensor (inductive sensor) is secured to the underside of the valve body.
- For transmissions with hydraulic regulation -E18/2-, the transmission input speed sensor (camshaft position sensor) is secured behind valve body at transmission housing.

Information about which transmission is installed:

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00*

01-26

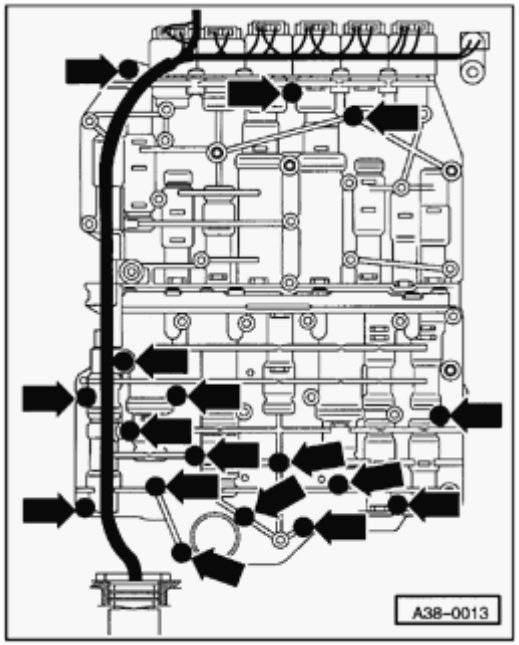


Fig. 7 Wiring harness with integrated Transmission Fluid Temperature Sensor -G93-

Location: The wiring harness is secured to the valve body.

The wiring harness can be removed with the valve body removed and the transmission installed.

Wiring harness in transmission, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

ATF Temperature Sensor -G93-, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

01-27

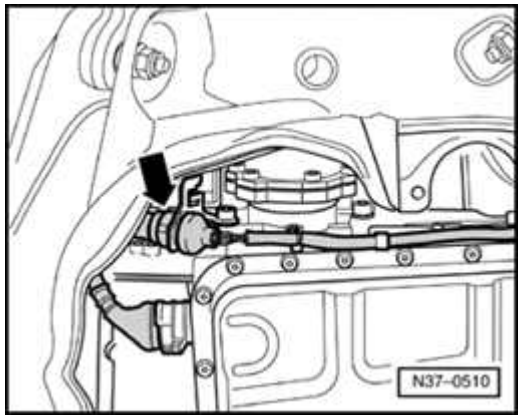


Fig. 8 Multi-function Transmission Range (TR) switch -F125-

Location: The multi-function switch -1- is located on left at transmission; Multi-pin connector for multi-function switch -arrow-.

Multi-function TR switch, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

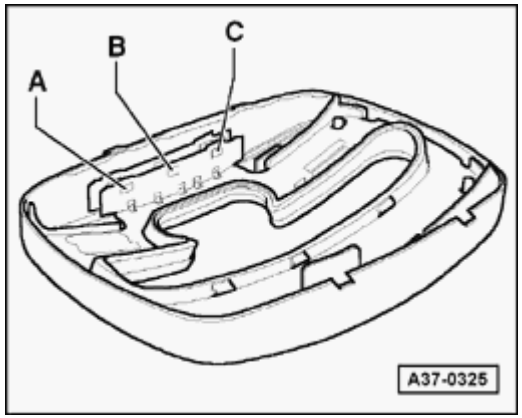


Fig. 9 Tiptronic switch -F189-

Installation location: The tiptronic switch is integrated into the conductor strip of the symbol insert in the cover of the shift mechanism.

Note:

This switch is not installed on shift mechanisms without tiptronic function.

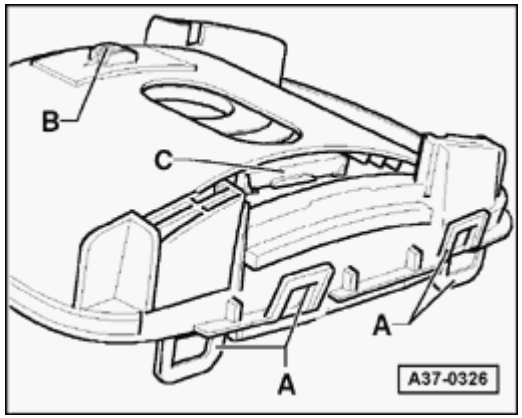
The switch consists of 3 hall-effect sensors (-A-, -B-, -C-), which are activated via a magnet on the lateral gate cover of the gate cover.

A - Sensor for down-shift

B - Sensor for Tiptronic-recognition

C - Sensor for up-shift

- If malfunctions occur, the switch for tiptronic must be checked for interference in Read measuring value block ⇒ page 01-186 and during the electrical test ⇒ page 01-273 .



In case of problems, first check the magnet at the lateral gate cover -C- of the gate cover is properly attached, replace gate cover, if necessary. Only replace the symbol insert with integrated conductor strip after checking the wires. For vehicles with tiptronic-sport steering wheel, also check the buttons at steering wheel and their wire connections.

Tiptronic switch -F189-, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37; repairing shift mechanism*

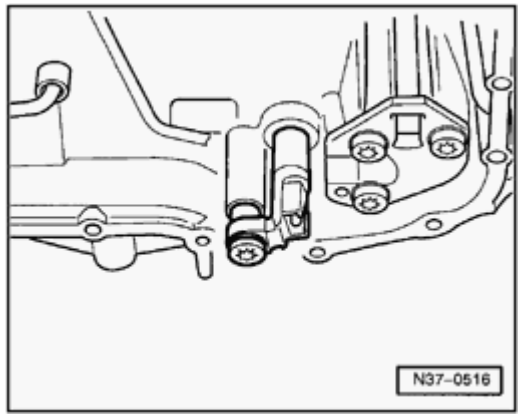


Fig. 10 Transmission Vehicle Speed (VSS) Sensor -G38-

Location: The transmission vehicle speed sensor is located at right rear in the transmission. It is also referred to as the Sensor for Transmission Output RPM -G195-.

Transmission VSS sensor -G38-, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

01-29

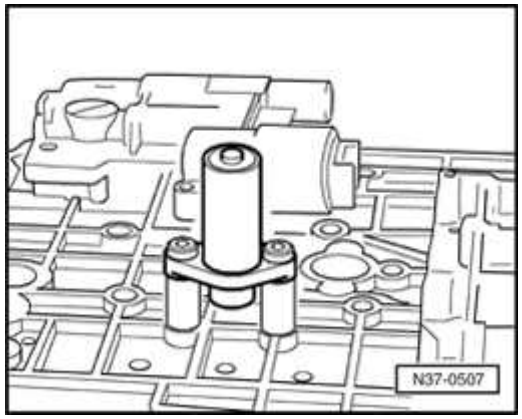
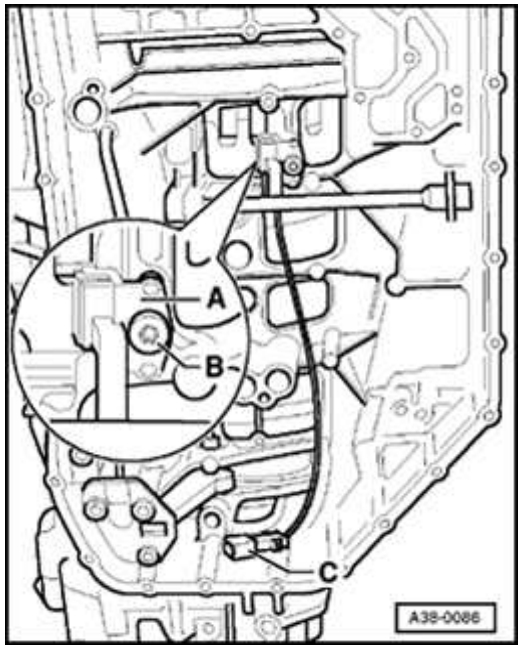


Fig. 11 Sensor for Transmission RPM -G182-

Installation location:

On transmissions with hydraulic regulation -E17-, the Sensor for Transmission RPM is secured to the underside of the valve body (see illustration). For these transmissions the sensor is an inductive sensor.



On transmissions with hydraulic regulation -E182-, the transmission input speed sensor -A- is secured behind the valve body at the transmission housing. On these transmissions the sensor is a hall effect sensor.

Information about which transmission is installed

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00*

Sensor for Transmission RPM -G182-, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

01-30

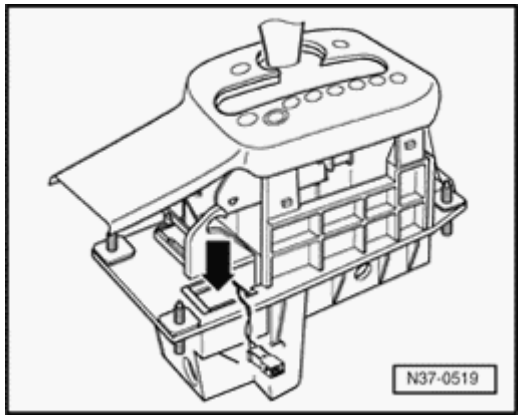


Fig. 12 Shift Lever Lock Solenoid -N110-

The Shift Lever Lock Solenoid is located in the shift lever housing -arrow-.

Shift Lever Lock Solenoid, removing and installing

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

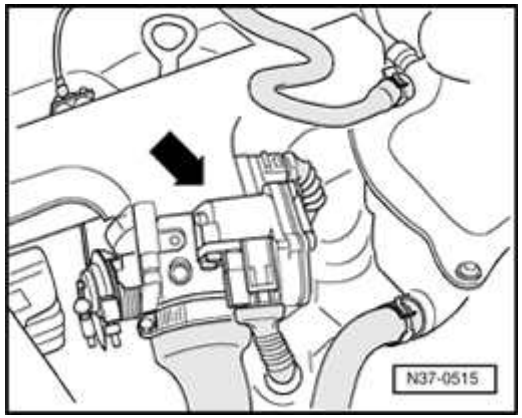


Fig. 13 Throttle Position (TP) Sensor -G69-

Location: integrated in Throttle Valve Control Module -J338- -arrow-.

The location is described in the applicable engine repair manual under repair Group 01, 23 or 24.

01-31

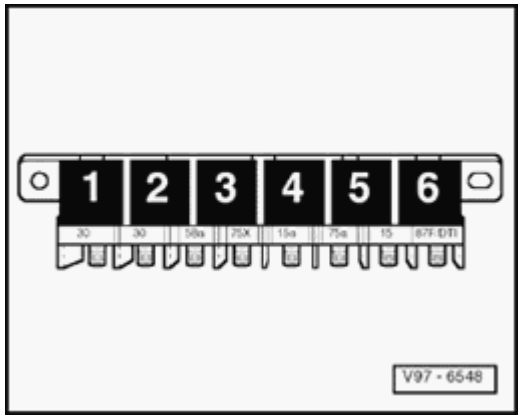


Fig. 14 Starting interlock relay -J207

IThe relay is located on the central electric.

For relay assignment

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Fig. 15 Transmission range selector lever display -Y6-

Located in instrument cluster

Removing and installing transmission range selector lever display

⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

01-32

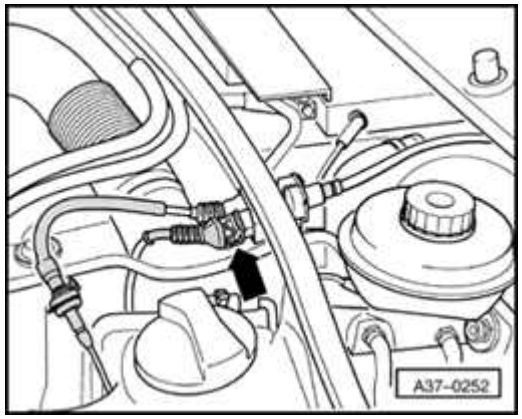


Fig. 16 Kick-down switch -F8-

Engines without E-Gas:

The kick-down switch is integrated in the accelerator cable in the plenum chamber, behind bulkhead -arrow-.

Engines with E-gas:

The kick-down switch is integrated in the throttle position sensor and Sensor 2 for Accelerator Position (-G79-, -G185-).

A learning procedure must be performed for the shift point of the kick down switch for engines with E-gas. If the throttle position sensor (-G79-, -G185-) is removed, exchange the engine control module or disconnect the battery. Learning procedure can be found in ⇒ Repair Manual, Fuel Injection & Ignition, Repair Group 24; Kick down shift point, checking.

Kick-down switch, removing and installing

- To remove and install the kick down switch, the accelerator cable must be removed and installed and then adjusted or the throttle position sensor (38-G79-, -G185-) must be replaced.

⇒ *Repair Manual, Fuel Supply System, Repair Group 20, accelerator pedal mechanism, repairing Front and All Wheel Drive*

01-33

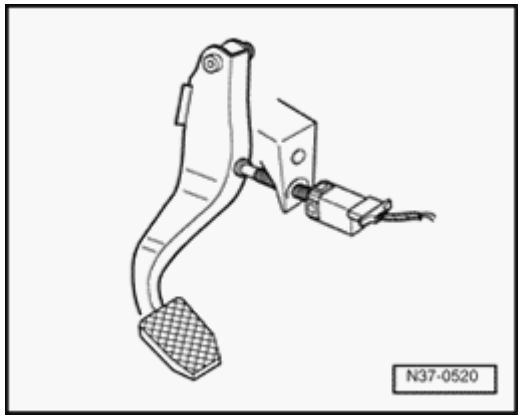


Fig. 17 Brake light switch -F-

The brake light switch -arrow- is located on the pedal cluster.

Brake light switch, removing and installing

⇒ *Repair Manual, Brake System, Repair Group 46*

Note:

For engine with E-gas, the brake light signal is transmitted from the engine control module to the transmission control module via the CAN-Bus.

On Board Diagnostic (OBD), initiating

Additional information

- Audi A4 Repair Manual, 5 Spd. Automatic Transmission 01V,
- Electrical Wiring Diagrams, Troubleshooting & Component Locations
- Parts catalog

Safety precautions

If special testing equipment is required during test drive, note the following:

WARNING!

- ***Always secure test and measuring instruments to the rear seat and have it operated by a second person from that location.***
- ***If test and measuring equipment is operated from the passenger seat, the passenger-side airbag could be activated in case of an accident and could lead to injury to the person sitting there.***

01-35

To reduce the risk of personal injury and/or damage of electric and electronic components, always observe the following:

- Always switch the ignition off before connecting or disconnecting testers or measurement tools.
- It is possible that the control module will recognize a malfunction and store a DTC during some tests. After completing all tests and repairs, check DTC memory and erase the memory.
- Always switch ignition off before disconnecting and connecting the battery to avoid damaging the transmission control module.

Vehicle Diagnosis, Measuring and Information System VAS 5051 or V.A.G 1551 scan tool, connecting and selecting functions

Test requirements

- Selector lever in "P" position and parking brake applied.
- Vehicle voltage supply OK
- Power supply and fuses for respective system OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Ground (GND) connections and Ground point for transmission OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

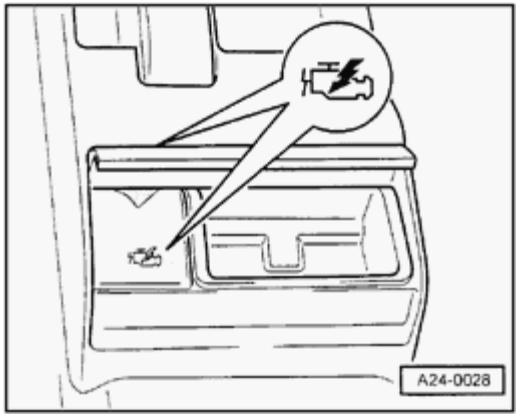
- Check Ground connections for corrosion and

damage and repair if necessary.

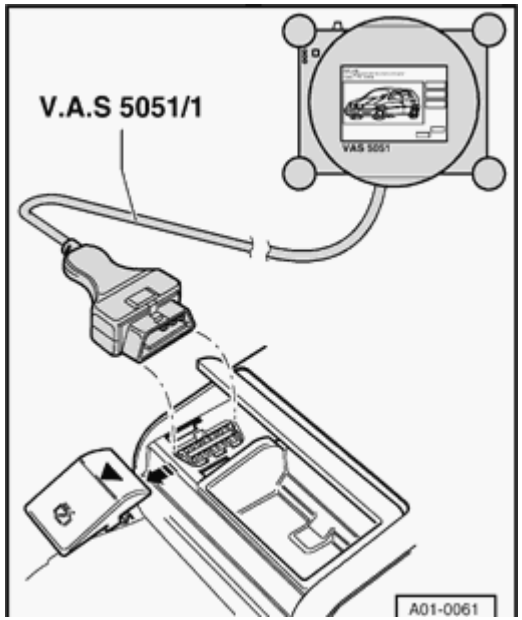
- Check battery Ground (GND) strap and Ground strap between battery and transmission.

- Switch ignition off.

For vehicles up to m. y. 2000

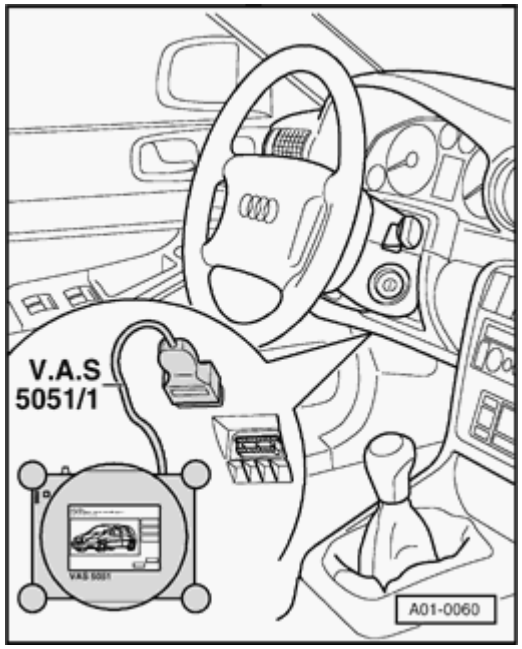


- The Data Link Connector (DLC) is located behind the cover in the rear ash tray (center console) for vehicles up to m. y. 2000
- Open rear ashtray (center console) and remove cover for DLC.



- Connect VAS5051 tester to vehicle with VAS5051/1 diagnostic cable. Alternately, V.A.G1551 Scan Tool can also be used, using VAG1551/3 adapter.

01-38



For vehicles from m. y. 2000

- The Data Link Connector (DLC) is located below the kneebar left of the steering wheel. for vehicles up to m. y. 2000
- Connect VAS 5051 tester to vehicle with VAS 5051/1 diagnostic cable. Alternately, V.A.G 1551 Scan Tool can also be used, using VAG 1551/3 adapter.

CAUTION!

- ***When performing road tests with testers and measuring equipment, such equipment must only be operated from the rear seat.***
- ***Observe all safety precautions listed on page 01-34***

Note:

The following description applies to the V.A.G 1551 Scan Tool. For the Vehicle Diagnosis, Measuring and Information System VAS 5051 please refer to the operating instructions.

01-39

VAG - On Board Diagnostic HELP
1 - Rapid data transfer
2 - Blink code output

➢ Indicated on display [1)]

[1)] Operating modes 1 and 2 are displayed alternately

Notes:

- *Get additional operating instructions by pressing the HELP key of V.A.G 1551.*
- *Use the → key to advance within the program sequence.*
- *An automatic check (keys 00) can be done in operating mode 1 "Rapid data transfer". This way all vehicle control modules will be checked automatically.*

⇒ *Scan tool V.A.G 1551 operating instructions.*

- Switch on ignition.
- Switch on printer with the Print key (indicator lamp in key lights up).
- Press key 1 for "Rapid data transfer" mode.

Rapid data transfer	**HELP**
Enter address word XX	

➢ Indicated on display:

- Press keys 0 and 2. (Enter the address word "transmission electronics" with 02.)

Rapid data transfer	**Q**
02 Transmission electronics	

➢ Indicated on display:

- Press Q button to confirm entry.

01-40

8D0927156BT AG5 01V 2.81V USA 1416 →
Coding 00002 **WSC 00000**

Appears on display:

The control module identification is displayed:

Control module identification

Depending on the software version, the control module may indicate a different control module identification as shown in this example. Allocation of control module ⇒ Parts catalog.

- 8D0927156BT: Part number
- AG5 01V: 5-speed automatic transmission 01V
- 2.8l 5V: Engine version
- USA: (country), USA and CANADA
- 1416: 14 = program version; 16 = data version
- Coding 00002: Coding ⇒ page 01-180
- WSC 00000: Dealer number of V.A.G 1551, with the last coding was performed

Control module does not answer! HELP

Indicated on display:

- By pressing the HELP key, a list of possible malfunction is printed out.
- After eliminating the possible causes of malfunctions, enter address word 02 for "transmission electronics" and confirm.

01-41

If again "Control module does not answer!" appears:

Control module does not answer! HELP

Indicated on display:

Check control module voltage supply.

- Perform test step 1 ⇒ page 01-273 , Electrical check.
- Check wiring connections to diagnostic connectors

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Replace control module if necessary

  Location and removing and installing of control module ⇒ page 01-273 , item 1

- Press → key.

Rapid data transfer HELP

Select function XX

Indicated on display:

- After the HELP key is pressed, a list of possible functions is printed out.

01-42

List of selectable functions

		Page
01 -	Check control module version ⇒ On Board Diagnostic (OBD), initiating	⇒ Page 01-34
02 -	Check DTC memory	⇒ Page 01-43
03 -	Output Diagnostic Test Mode	⇒ Page 01-163
05 -	Erase DTC memory	⇒ Page 01-178
06 -	End output	
07 -	Code control module	⇒ Page 01-180
08 -	Read measured value block	⇒ Page 01-186

Disregard functions, which can be printed out by pressing the HELP key.

- After checking a function the V.A.G 1551 returns to the following start position:

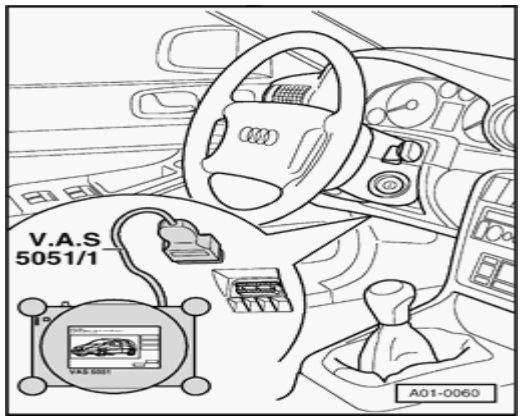
Rapid data transfer **HELP**

Select function XX

Indicated on display:

01-43

DTC Memory, checking



- Connect Vehicle Diagnosis, Measuring and Information SystemVAS 5051 to vehicle using VAS 5051/1 diagnostic wire, or use V.A.G 1551 Scan Tool with VAG 1551/3 adapter.
- Advance until "Select function XX" appears in the display ⇒ page 01-36 .

Rapid data transfer **HELP**

Select function XX

Indicated on display:

- Press keys 0 and 2. (The function "Check DTC memory" is selected with 02).

Rapid data transfer **Q**

02 - Check DTC memory

Indicated on display:

- Press Q button to confirm entry.

X DTCs recognized!

The number of malfunctions stored or "No DTC recognized!" will be shown on the display.

- Press the → key.

Stored DTCs will be displayed and printed out one after the other.

- Repair malfunctions, after displaying and printing out the last

malfunction according to DTC table ⇒ page 01-45 .

- Press the → key.

01-44

Rapid data transfer	**HELP**
Select function XX	

➢ Indicated on display:

Note:

After DTC memory has been checked and malfunctions have been repaired:

- Erase DTC memory

01-45

Diagnostic Trouble Code (DTC) table

Important:

Note:

- *In the following, all possible malfunctions are listed in ascending order of DTC. These malfunctions can be recognized by the transmission control module -J217-. They are then displayed on the VAS 5051 tester or V.A.G 1551 scan tool when checking DTC memory content ⇒ page 01-53 .*
- *Starting on the next page is a list of all DTCs with all MIL conditions.*
- *The DTC is only printed out in the "Rapid data transfer" operating mode when the printer of the V.A.G 1551 ST is switched on. Example: DTC 16987 P0603*
- *If malfunctions only occur sometimes, or if the DTC memory was not erased after malfunction repair, these malfunctions are displayed as "sporadic malfunctions" for a pre-determined time period. Malfunction recognition of transmission control module, ⇒ page 01-1 .*
- *If components are indicated as being faulty during the check of the DTC memory, test the wiring to the components for short and open circuit according to wiring diagram.*

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

01-46

List of all DTCs with the Malfunction Indictor Light (MIL) condition

Notes:

- *Dcy = Driving cycle, conditions for recognition of a Dcy ⇒ page 01-7 .*
- *Explanation of the Malfunction indicator Lamp (MIL) ⇒ page 01-5 .*
- *The "MIL" column in the DTC table indicates the condition for which the Malfunction Indicator Lamp (MIL) would be switched on. If, for example, "2 Dcy" is indicated in the table, the MIL would light up after two driving cycles. If "Off" is indicated, the malfunction has no influence on the MIL. If "On" is indicated, the MIL will light up immediately after the malfunction occurs.*
- *"Hydraulic control" column: What transmission has what hydraulic control can be found in Repair Manual:*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code numbers, Aggregate allocation, gear ratios, equipment*

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
00258 P0753	2 Dcy	E17	DTCs starting at ⇒ page 01-53
00260 P0758	2 Dcy	E17	
00262 P0763	2 Dcy	E17	
00264 P1813	2 Dcy	E17	

00266 P1818	2 Dcy	E17	
00268 P1823	2 Dcy	E17	
00270 P1828	2 Dcy	E17	

01-47

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
00293 P0705	2 Dcy	E17	
00296 P1704	Off	E17	
00297 P0722	On	E17	DTCs starting at
00300 P0712	Off	E17	⇒ page 01-53
00300 P0713	Off	E17	
00518 P0121	Off	E17	
00526 P0703	2 Dcy	E17	
00529 P0727 with CAN-Bus	2 Dcy	E17	
00529 P0727 without CAN-Bus	Off	E17	
00532 P1746	Off	E17	
00543 P0726	Off	E17	
00545 P0702	2 Dcy	E17	
00545 P1781	Off	E17	
00545 P1782	Off	E17	
00638 P0702	Off	E17	

01-48

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
00638 P1767	Off	E17	
00652 P0732	On	E17	
00652 P0733	On	E17	
00652 P0734	On	E17	
00652 P0735	On	E17	
00668 P0560	Off	E17	
01044 P1749	Off	E17	
01192 P0741	Off	E17	DTCs starting at
01196 P1625	2 Dcy	E17	⇒ page 01-53
01236 P1760	Off	E17	
16987 P0603	On	E18/2	
16989 P0605	2 Dcy	E18/2	
17087 P0703	Off	E18/2	
17090 P0706	2 Dcy	E18/2	
17094 P0710	Off	E18/2	

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
17095 P0711	Off	E18/2	
17096 P0712	Off	E18/2	
17097 P0713	Off	E18/2	
17100 P0716	2 Dcy	E18/2	
17101 P0717	On	E17	
17105 P0721	2 Dcy	E18/2	DTCs starting at
17114 P0730	2 Dcy	E18/2	⇒ page 01-53
17115 P0731	2 Dcy	E18/2	
17116 P0732	2 Dcy	E18/2	
17117 P0733	2 Dcy	E18/2	
17118 P0734	2 Dcy	E18/2	
17119 P0735	2 Dcy	E18/2	
17125 P0741	2 Dcy	E18/2	
17135 P0751	2 Dcy	E18/2	
17136 P0752	2 Dcy	E18/2	

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
17137 P0753	2 Dcy	E18/2	
17140 P0756	2 Dcy	E18/2	
17141 P0757	2 Dcy	E18/2	
17142 P0758	2 Dcy	E18/2	
17145 P0761	2 Dcy	E18/2	
17146 P0762	2 Dcy	E18/2	DTCs starting at
17147 P0763	2 Dcy	E18/2	⇒ page 01-53
17968 P1560	2 Dcy	E18/2	
18112 P1704	Off	E18/2	
18141 P1733	Off	E17 and E18/2	
18147 P1739	Off	E17 and E18/2	
18152 P1744	Off	E17 and E18/2	
18153 P1745	2 Dcy	E18/2	
18155 P1747	2 Dcy	E18/2	

01-51

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
18156 P1748	2 Dcy	E18/2	
18157 P1749	Off	E18/2	
18158 P1750	2 Dcy	E18/2	
18159 P1751	2 Dcy	E18/2	
18169 P1761	Off	E18/2	
18170 P1762	Off	E18/2	
18171 P1763	Off	E18/2	DTCs starting at
18179 P1771	Off	E17	⇒ page 01-53
18180 P1772	Off	E17	
18192 P1784	Off	E17	
18193 P1785	Off	E17	
18222 P1814	2 Dcy	E18/2	
18223 P1815	2 Dcy	E18/2	
18227 P1819	2 Dcy	E18/2	
18228 P1820	2 Dcy	E18/2	
18232 P1824	2 Dcy	E18/2	

01-52

V.A.G1551 Scan Tool print out	Condition of MIL	Hydraulic Control	Possible malfunction cause and corrective action
18233 P1825	2 Dcy	E18/2	
18237 P1829	2 Dcy	E18/2	
18238 P1830	2 Dcy	E18/2	
18242 P1834	2 Dcy	E18/2	
18243 P1835	2 Dcy	E18/2	
18249 P1841	2 Dcy	E18/2	
18258 P1850	Off	E18/2	DTCs starting at
18259 P1851	Off	E18/2	⇒ page 01-53
18262 P1854	Off	E18/2	
18263 P1855	Off	E18/2	
18264 P1856	2 Dcy	E17 and E18/2	
18265 P1857	Off	E17 and E18/2	
18269 P1861	Off	E18/2	
65535	On	E17	

Output Diagnostic Test Mode (DTM) (scan tool function 03)

Note:

There are two different transmissions:

- *Transmission with hydraulic controls -E17-, on which the transmission input speed sensor (inductive sensor) is secured to the underside of the valve body.*

- *Transmission with hydraulic regulation -E18/2-, on which the transmission input speed sensor (camshaft position sensor) is secured behind the valve body at the transmission housing.*

For information on which transmission is installed, refer to tables from the following Repair Manual:

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00*

Output Diagnostic Test Mode (DTM) for transmission with hydraulic regulation -E17-
⇒ **page 01-164**

Output Diagnostic Test Mode (DTM) for transmission with hydraulic regulation -

E18/2- ⇒ page 01-171

Output Diagnostic Test Mode (DTM) (scan tool function 03), transmissions with hydraulic regulation -E17-

Note:

- *The Output Diagnostic Test Mode (DTM) can only be performed when the ignition is switched off, the selector lever is in position "P", the engine is not running, and the vehicle is stationary.*
- *DTM will be terminated when the engine is started.*
- *The function of solenoid valves 1 -N88-, 2 -N89-, 3 -N90- and the solenoids for the selector lever lock are checked acoustically during the DTM. Avoid noise in the surrounding area during the acoustic check, because the switching noise (clicking) of the actuators is very quiet.*
- *The solenoid valves 4 -N91-, 5 -N92-, 6 -N93- and 7 -N94- are activated during the DTM. A direct functional check of these valves is not possible. But possible electrical faults which occur during the activation, will be recognized by the On Board Diagnostic (OBD) and stored in the DTC memory.*

- *When performing the Output Diagnostic Test Mode (DTM), the individual actuators will be activated until the → button is pressed.*

- *Only one complete DTM is possible after switching the ignition on. To repeat DTM, the ignition must be switched off and on again.*

	Activation sequence
1.	Solenoid Valve 1 -N88-
2.	Solenoid Valve 2 -N89-
3.	Solenoid Valve 3 -N90-
4.	Shift Lock solenoid -N110-
5.	Solenoid Valve 4 -N91-
6.	Solenoid Valve 5 -N92-
7.	Solenoid Valve 6 -N93-
8.	Solenoid Valve 7 -N94-
9.	Kick-down Switch -F8- (Kick-down for air conditioner)
10.	Solenoid Valve Relay

01-166

Test sequence

- Connect VAS 5051 tester or V.A.G 1551 scan tool and enter address word 02 for "Control module for Transmission electronics" ⇒ page 01-40 .

Ignition must be switched off during this process.

Rapid data transfer HELP **Select function XX**	Indicated on display:

- Press keys 0 and 3. (03 selects the function "Output Diagnostic Test Mode").

Rapid data transfer Q **03 - Output Diagnostic Test Mode**	Indicated on display

- Press Q- button to confirm entry.

Output Diagnostic Test Mode → **Solenoid valve 1 -N88**	Indicated on display

- Valve is activated (clicks). To switch to next actuator press → key.
- If valve does not click, perform electrical check ⇒ Page 01-273 .

♦ Malfunction is stored in DTC memory, see DTC table ⇒ Page 01-45 .

01-167

Output Diagnostic Test Mode →

Solenoid valve 2 -N89

Indicated on display

- Valve is activated (clicks) To switch to next actuator press → key.
- If valve does not click, perform electrical check ⇒ Page 01-273 .

Output Diagnostic Test Mode →

Solenoid valve 3 -N90

Indicated on display

- Valve is activated (clicks). To switch to next actuator press → key.
- If valve does not click, perform electrical check ⇒ Page 01-273 .

Malfunction is stored in DTC memory, DTC table ⇒ Page 01-45 .

Output Diagnostic Test Mode →

Selector lever lock solenoid -N110

Indicated on display

- Solenoid is activated (clicks). Switch to next actuator press → key.
- If solenoid does not click, perform electrical check ⇒ Page 01-273 .

♦ Malfunction is stored in DTC memory, DTC table ⇒ Page 01-45 .

01-168

Output Diagnostic Test Mode → **Solenoid valve 4 -N91**	⮜ Indicated on display - Valve is activated (clicks). To switch to next actuator press → key. Electrical malfunctions will be stored in DTC memory. See DTC table ⇒ Page 01-45 .
Output Diagnostic Test Mode → **Solenoid valve 5 -N92**	⮜ Indicated on display - Valve is activated (clicks). To switch to next actuator press → key. Electrical malfunctions will be stored in DTC memory. See DTC table ⇒ Page 01-45 .
Output Diagnostic Test Mode → **Solenoid valve 6 -N93**	⮜ Indicated on display - Valve is activated (clicks). Switch to the next actuator press → key. Electrical malfunctions will be stored in DTC memory. See DTC table ⇒ Page 01-45 .

01-169

Output Diagnostic Test Mode - →

Solenoid valve 7 -N94

➢ Indicated on display

- Valve is activated (clicks). To switch to next actuator press → key.

Electrical malfunctions will be stored in DTC memory. See DTC table ⇒ Page 01-45 .

Output Diagnostic Test Mode - →

Kick-down switch -F8

➢ Indicated on display

Notes:

- *It is not the kick-down switch -F8-, but the switch-off function for the air conditioner in transmission control module -J217- which is activated.*
- *If the kick-down switch is operated, the Transmission Control Module (TCM) grounds the output to air conditioner. This briefly switches off the air conditioner compressor.*
- *Can be disregarded here.*
- *The signal can be checked in measured value block 011 ⇒ 01-186 .*
- *For checking function of Kick-down switch -F8- ⇒ Page 01-273 Electrical check.*

⇒

- Press → key to switch to the next actuator.

01-170

Output Diagnostic Test Mode → **Solenoid valve relays**	Indicated on display - Solenoid valves activated in position "P" are activated (click), press → key to switch to the next actuator. ♦ Can be disregarded. - Press → key.
Output Diagnostic Test Mode → **End**	Indicated on display - Press → key
Function is unknown or → **cannot be performed at this time**	Indicated on display - Pressing the → key will terminate the Output Diagnostic Test Mode.
Rapid data transfer **HELP** **Select function XX**	Indicated on display: - To repeat Output Diagnostic Test Mode, the ignition must be switched off and then on again. Now select function 03 - Output Diagnostic Test Mode again.

01-171

Output Diagnostic Test Mode (DTM) (scan tool function 03), transmissions with hydraulic regulation -E18/2-

Note:

- *The Output Diagnostic Test Mode (DTM) can only be performed when the ignition is switched off, the selector lever is in position "P", the engine is not running, and the vehicle is stationary.*
- *DTM will be terminated if the engine is started.*
- *The function of solenoid valves 1 -N88-, 2 -N89-, 3 -N90- and the solenoids for the shift lock are checked acoustically during DTM. Avoid noise in the surrounding area during the acoustic check, because the switching noise (clicking) of the final controls is very quiet.*
- *The pressure control valves 1 -N215-, 2 -N216-, 3 -N217- and 4 -N218- are activated during DTM. A direct functional check of these valves is not possible. But possible electrical faults which occur during the activation will be recognized and stored in DTC memory.*

- *When performing the Output Diagnostic Test Mode (DTM) the individual actuators will be activated until the → button is pressed.*

- *Only one complete DTM is possible after switching the ignition on. To repeat DTM, the ignition must be switched off and on again.*

	Activation sequence
1.	Solenoid Valve 1 -N88-
2.	Solenoid Valve 2 -N89-
3.	Solenoid Valve 3 -N90-
4.	Shift Lock solenoid -N110-
5.	Pressure Control Valve -1- for Auto. Transmission -N215-
6.	Pressure Control Valve -2- for Auto. Transmission -N216-
7.	Pressure Control Valve -3- for Auto. Transmission -N217-
8.	Pressure Control Valve -4- for Auto. Transmission -N218-
9.	Voltage supply for solenoid valves

01-173

Test sequence

- Connect VAS 5051 tester or V.A.G 1551 scan tool and enter address word 02 for "Control module for transmission electronics" ⇒ page 01-40 .

Ignition must be switched off during this process.

Rapid data transfer HELP **Select function XX**	⮜	Indicated on display:

- Press keys 0 and 3. (03 selects function "Output Diagnostic Test Mode").

Rapid data transfer Q **03 - Output Diagnostic Test Mode**	⮜	Indicated on display

- Confirm entry with Q button.

Output Diagnostic Test Mode (DTM) **Shift valve 1 ⇒ Solenoid Valve 1 -N88**	⮜	Indicated on display:

- Valve is activated (clicks), to switch to the next actuator press → key.
- If valve does not click, perform electrical check ⇒ Page 01-273 .

♦ Malfunction is stored in DTC memory, see DTC table ⇒ Page 01-45

01-174

Output Diagnostic Test Mode (DTM) **Shift valve 2 ⇒Solenoid Valve 2 -N89**	Indicated on display: - Valve is activated (clicks) To switch to next actuator press → key. - If the valve does not click, perform electrical check ⇒ Page 01-273 . ♦ Malfunction is stored in DTC memory, see DTC table ⇒ Page 01-45
Output Diagnostic Test Mode (DTM) **Shift valve 3 ⇒ Solenoid Valve 3 -N90**	Indicated on display: - Valve is activated (clicks). To switch to the next actuator press → key. - If valve does not click, perform electrical check ⇒ Page 01-273 . ♦ Malfunction is stored in DTC memory, see DTC table ⇒ Page 01-45
Output Diagnostic Test Mode (DTM) **Shift lock Solenoid -N110**	Indicated on display: - Solenoid is activated (clicks). To switch to the next actuator press →key. - If solenoid does not click, perform electrical check ⇒ Page 01-273 . ♦ Malfunction is stored in DTC memory, DTC table ⇒ Page 01-45

01-175

Output Diagnostic Test Mode (DTM)

Press. control valve -1- for auto. trans. -N215

Indicated on display:

- Pressure control valve -N215- is activated (clicks). To switch to the next actuator press → key.

♦ Electrical malfunctions will be stored in DTC see DTC table ⇒ Page 01-45 .

Output Diagnostic Test Mode (DTM)

Press. control valve -2- for auto. trans. -N216

Indicated on display:

- Pressure Control valve -N216- is activated (clicks). To switch to the next actuator press → key.

♦ Electrical malfunctions will be stored in DTC, see DTC table ⇒ Page 01-45 .

Output Diagnostic Test Mode (DTM)

Press. control valve -3- for auto. trans -N217

Indicated on display:

- Pressure Control valve -N217- is activated (clicks). To switch to the next actuator press → key.

♦ Electrical malfunctions will be stored in DTC, see DTC table ⇒ Page 01-45 .

01-176

Output Diagnostic Test Mode (DTM)

Press control valve -4- for auto. trans. -N218

Indicated on display:

- Pressure Control valve -N218- is activated (clicks) To switch to next actuator press → key.
  - Electrical malfunctions will be stored in DTC memory, see DTC table ⇒ Page 01-45

Note:

Output Diagnostic Test Mode (DTM)

Press reg. valve -5- for auto trans. -N233

"Pressure Regulating Valve -5- for Automatic Transmission -N233-" could now be displayed erroneously due to a software error, even though it does not exist. Disregard this display. Press→ button to switch to the next actuator.

Output Diagnostic Test Mode (DTM)

Voltage supply for solenoid valves

Indicated on display:

Solenoid valves activated in position "P" are activated (click). Press →key to switch to the next actuator.

- Can be disregarded.

- Press → key.

01-177

Function is unknown or → **cannot be carried out at the moment**	≺ Indicated on display - Pressing the → key will terminate Output Diagnostic Test Mode.
Rapid data transfer HELP **Select function XX**	≺ Indicated on display: - To repeat Output Diagnostic Test Mode, switch ignition off and then on again. Now select function 03 - Output Diagnostic Test Mode again.

01-178

DTC Memory, erasing (scan tool function 05)

Requirement:

- DTC memory checked ⇒ page 01-43 .

After DTC memory has been checked:

Rapid data transfer HELP **Select function XX**

Indicated on display:

- Press keys 0 and 5. (With function 05 "Erase DTC memory" is entered)

Rapid data transfer Q **05 Erase DTC memory**

Indicated on display:

- Confirm entry with Q button.

WARNING! **DTC memory was not checked**

Indicated on display:

Note:

If the ignition was switched off e.g. between checking the DTC memory and erasing DTC memory, the DTC memory is then not erased.

- Exactly follow the work sequence. The DTC memory must first be checked.

01-179

Rapid data transfer →

DTC memory is erased!

Indicated on display:

(The DTC memory will be erased approx. 5 seconds. after the display appears.)

The DTC memory is now erased.

Note:

Wait about 1 minute before checking the DTC memory again.

System cannot be checked!

Indicated on display:

1 Fault recognized !

00811 3333

System cannot be checked

Print out with printer switched on:

Transmission Control Module (TCM) -J217- was not given sufficient time to recognize faults.

- Wait about 1 minute before checking the DTC memory again.
- After checking and erasing DTC memory, test drive the car and check DTC memory again.

When the DTC memory is being checked, the following display should appear:

"No DTC recognized!"

Transmission Control Module (TCM), coding (scan tool function 07)

Procedure

- Connect VAS5051 tester or V.A.G1551 scan tool and select Transmission Control Module (TCM) using "address word" 02 ⇒ page 01-40 .

Ignition must remain switched on.

Rapid data transfer	**HELP**
Select function XX	

Indicated on display

Print out control module identification:

- Switch on printer by pressing print button (indicator lamp in button lights up).
- Press buttons -0- and -1-.
- Press -Q- button to confirm input.

8D0927156BT AG5 01V 2.8l 5V USA 1416	
Coding 00002	**WSC 00000**

Indicated on display

Control module identification is displayed:

Depending on the control module version (software version), the control module may indicate a different identification than shown in this example. For allocation of control module

⇒ *Parts catalog*

01-181

Explanation of display:

- 8D0927156BT: Part number
- AG5 01V: Automatic Transmission, 5-speed 01V
- 2,8l 5V: Engine type
- USA: Market, USA and Canada
- 1416: 14 = software version, 16 = data version
- Coding 00002: Coding (see Coding tables ⇨ page 01-184)
- WSC 00000: Factory identification of V.A.G1551, with the last coding that was performed

- Press → button.

TCM identification can only be printed out when printer is switched on.

Rapid data transfer **HELP**

Select function XX

Indicated on display

Note:

Read Transmission Control Module (TCM) identification to determine which transmission/engine combination is present in this case, see explanation above. Then use coding table to determine whether the appropriate code was entered.

- Press buttons -0- and -7-. This selects "Coding Control Module", function 07.

01-182

Note:

Coding can only be performed with ignition on and selector lever in position "P" or "N". Accelerator pedal must be in idle position. Vehicle must be stationary and engine must not be started.

Rapid data transfer **Q**	Indicated on display
07 Code control module	

- Press -Q- button to confirm input.

Code control module **HELP**	Indicated on display
Input code number XXXXX	

- Enter code

Note:

Find control module identification in coding tables starting on ⇒ page 01-184 and enter it into tester. The Dynamic Shifting Program (DSP) should remain on at all times if possible.

- Press -Q- button to confirm input.

Note:

DTC memory in the control module is automatically erased following coding.

- Press → button.

Rapid data transfer	HELP
Select function XX	

Indicated on display

- Check TCM version (press buttons -0- and -1-), confirm input with Q button and check coding ⇒ page 01-34 .

01-183

DTC →

Coding XXXXX not accepted

When indicated on display: An attempt was made to enter a code that is not valid or unrecognized by the control module.

Note:

- *If a wrong code was entered, the control module will retain the old code.*

8D0927156BT AG5 01V 2.8l 5V USA 1416

Coding 00002 WSC 00000

Indicated on display

Note:

- *A control module identification that has been wrongly entered is only indicated alongside the old coding for older V.A.G1551 tester cards.*

Function is unknown or cannot be carried out at the moment →

When indicated on display:

An attempt was made to perform coding in an unauthorized coding condition, e.g. with the vehicle was being driven.

01-184

Coding tables

For vehicles without E-gas

Code	Transm. Code	Engine	Dynamic Shift Program (DSP)	Market
00000	DDT DKB DRD DRN DTV	All valid engine/transmission combinations without E-gas This information is in the following repair manuals: ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*	DSP active	Rest of world and USA FWD and Quattro

For vehicles with E-gas

Code	Engine	Dynamic Shift Program (DSP)	Market
00000	Not permitted code		
00001	All valid engine/transmission combinations with E-gas	DSP active	Rest of world Quattro
00002	This information is in the following repair manuals:	DSP active	USA Quattro
00003	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*	DSP active	Rest of world FWD
00004		DSP active	USA FWD

Read Measuring Value Block (scan tool function 08)

Notes:

There are two types of transmissions:

- *1. Transmissions with hydraulic control -E17-: The sensor for transmission RPM (inductive sensor) is secured to the bottom of the valve body.*

- *2. Transmissions with hydraulic control -E18/2-: The sensor for transmission RPM (hall effect sensor) is secured to the transmission housing behind the valve body.*

Information about which transmission is installed

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

Read measuring value block for transmission with hydraulic control -E17- ⇒ page 01-187

Read measuring value block for transmission with hydraulic control E18/2 ⇒ page 01-228

Read Measuring Value Block (scan tool function 08) for transmissions with hydraulic control -E17-

Note:

For transmissions with hydraulic control -E18/2-, "Read Measuring Value Block" ⇒ *page 01-228*

WARNING!

To avoid accidents during measuring and test drives, observe safety precautions ⇒ ***page 01-34*** **.**

Procedure

- Connect VAS 5051 tester or V.A.G 1551 Scan Tool (ST) and select Transmission Control Module (TCM) using "address word" 02 ⇒ page 01-36 . Ignition must remain switched on.

Rapid data transfer HELP
Select function XX

Indicated on display

- Press PRINT button to turn on ST printer. Indicator lamp in button must light up.
- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

01-188

Read measuring value block Q **Enter display group number XXX**

When indicated on display:

- Enter desired display group number, display group overview, ⇒ page 01-189 .
- Press Q button to confirm input.

Read measuring value block 1 → **1 2 3 4**

Indicated on display (example) for display group 001:

Notes:

- *Explanation of values in the individual display fields ⇒ Test table page 01-194 .*
- *Display can be printed out when printer is switched on.*
- *To switch to a different display group, proceed as follows:*

Display group	V.A.G 1551	VAS 5051 tester
Higher	Press button -3-	Press ▲ button.
Lower	Press button -1-	Press ▼ button.

- If specified values are obtained in all display fields, press → button.

Rapid data transfer HELP **Select function XX**

Indicated on display (function selection):

01-189

Overview of selectable display group numbers for transmission with hydraulic control -E17-

Indicated on display (example)			
Display fields: **1 2 3 4** J J J	**Display group no.**	**Display field**	**Description**
Read measuring value block 1 → **0 RPM 0 RPM 0 RPM 4**	001	1 2 3 4	Engine speed (RPM) Sensor for Transmission RPM -G182- Transmission Vehicle Speed Sensor -G38- Driving range selected
Read measuring value block 2 → **0 0 % 0 RPM 4**	002	1 2 3 4	Dynamic code number Throttle valve value Transmission Vehicle Speed Sensor -G38- Driving range selected
Read measuring value block 3 → **PN active 0 km/h 12.8 V**	003	1 2 3 4	Brake "P" "N" lock Speed Supply voltage pin 54, 55

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 4 → **21.0 ° C P 1000**	004	1 2 3 4	ATF temperature Selector lever position Multi-function switch position On Board Diagnostic (OBD) [1] information Request for engine intervention[2]
Read measuring value block 5 → **0 0 0 4**	005	1 2 3 4	Solenoid valve 1 -N88- Solenoid valve 2 -N89- Solenoid valve 3 -N90- Driving range selected
Read measuring value block 6 → **0.747A 0.747A 0.747A 4**	006	1 2 3 4	Specified current of solenoid valve 4 -N91- Specified current of solenoid valve 5 -N92- Specified current of solenoid valve 6 -N93- Driving range selected

1) Only for vehicles with CAN-bus. For information about which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

2) Only for vehicles without CAN-bus. For information about which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 7 → **21.0 ° C 0.747A TC on 0 RPM**	007	1 2 3 4	ATF temperature Specified current of solenoid valve 7 -N94- Torque converter clutch Torque converter slip speed
Read measuring value block 8 → **0 % 5 %**	008	1 2 3 4	Kick down switch Throttle valve value Engine torque in Nm [1)] Throttle valve duty cycle in % [2)] Deceleration mode/engine under load
Read measuring value block 9 → **100 Nm 350 Nm 0 RPM 0%**	009 [1)]	1 2 3 4	Engine torque (actual) Maximum torque Engine speed (RPM) Throttle valve value

1) Only for vehicles with CAN-bus. For information about which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

2) Only for vehicles without CAN-bus. For information about which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 9 →	009 [2)]	1	Engine torque (actual)
		2	Engine speed (RPM)
100 Nm 0 RPM 0 % 0.00 ms		3	Throttle valve value
		4	Fuel consumption signal
Read measuring value block 10 →	010	1	Torque increase in torque converter
		2	Engine speed (RPM)
0,00 0 RPM 4		3	Gear selected
		4	Anti-Slip Regulation (ASR)
Read measuring value block 11 →	011	1	Selector lever position
		2	Tiptronic recognition
D M-switch up button Compr. ON		3	Tiptronic Switch -F189-
		4	Air conditioning kick down

[2)] Only for vehicles without CAN-bus For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, engine/transmission allocation, ratios, equipment*

01-193

Notes:

- *When the printer is switched on, the contents of the display will be printed out on the scan tool log.*
- *If specified values are not obtained in all display fields:*

- Press → button.

Rapid data transfer **HELP** **Select function XX**	<	Indicated on display

01-194

Test table for transmissions with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements	Spec. Value on V.A.G 1551 display	Corrective actions
001	1	Engine speed (RPM)	with engine running	approx. 0...8200 RPM	- Perform electrical test ⇒ page 01-273 - Check identification of Transmission Control Module (TCM) ⇒ page 01-273 , replace if necessary - Check DTCs of Engine Controlk Module (ECM) and if necessary check identification
	2	Sensor for transmission RPM - G182-	while driving, with gear selected[1)]	RPM	- see DTC table, DTC number 17100 / P0716 ⇒ page 01-45
			R	approx. 0...10	
	Continue ▼		1M	approx. 0...10	

[1)] While driving, a second mechanic is required to read specifications.

01-195

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
001	2	Sensor for Transmission RPM -G182-	1 With engine under load	approx. 0...10	- Perform electrical test ⇒ page 01-273
			1 In deceleration mode	approx. 0...300	- Read measuring value block, Display group number 007 and determine which elements are faulty or not activated while driving
			2	approx. 0...4000 1)	
			3	approx. 0...8200 1)	
			4	approx. 0...8200 1)	
Continue ▼			5	approx. 0...8200 1)	

1) Indication should mimic the current engine speed in display field 1, i.e. when engine speed increases or decreases, transmission input RPM should increase or decrease.

01-196

Only for transmission with hydraulic control E17

Display group No.	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
001	3	Transmission Vehicle Speed (VSS) sensor -G38- [2]	While driving, with gear selected[1]	... RPM [3]	- See appropriate DTC for Transmission Vehicle Speed Sensor (VSS) -G38- (also called sensor for transmission output RPM -G195-) [2]
			R	approx. 0...2000	- Perform electrical test ⇒ page 01-273
			1M, 1	approx. 0...1200	
			2	approx. 0...4000	
			3	approx. 0...5800	
			4	approx. 0...8200	- Read measuring value block, display group number 007
Continue ▼			5	approx. 0...8200	- Determine while driving which elements are faulty and which aren't active

Notes and footnotes for display field 1 to 3 of display group number 001 are on the next page.

01-197

1) While driving, a second mechanic is required to read specifications.

2) Also referred to as the sensor for transmission output RPM -G195-.

3) Indication should mimic the engine speed in display field 1, i.e. when engine speed increases or decreases, transmission RPM (output RPM) should increase or decrease.

Notes for display group number 001, display field 1 to 3;

- *Test conditions: Shifting process must be finished. Vehicle must not be in deceleration mode (no down-hill driving or engine braking).*

01-198

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
001	4	Gear selected	while driving [1]	Selector lever position		- Check solenoid valves. See display group number 005 and 006 - See DTC table, DTC numbers of appropriate solenoid valves - Check selector lever position. Display group number 004
				"N"	"1"..."5" [2]	
				"R"	"R"	
				"D"	"1" "2" "3" "4" "5"	
				"4"	"1" "2" "3" "4"	
				"3"	"1" "2" "3"	
				"2"	"1M" "2"	

Notes and footnotes for display field 4 of display group number 001 are on the next page.

01-199

1) While driving, a second mechanic is required to read specifications.

2) Transmission Control Module (TCM) is equipped with an automatic gear follower. The forward gear is indicated that the TCM would activate in selector lever position "D".

Note on selected gear :

- *Faulty solenoid valves or other diagnostic malfunctions can prevent the selection of certain gears.*

01-200

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
002	1	Dynamic code number (of dynamic shifting program)	Under normal driving conditions [1]	Min. value (very economical)	0	Determined by driving style and street conditions (acceleration, accelerator pedal movement, speed and load)
				Max. value (very sporty)	240	High values move shift points to higher engine speeds
			Warm-up program is active		241	
			Anti-Slip Regulation (ASR) active		242	Shifting avoided whenever possible
			Tiptronic recognition activated		243	- See appropriate DTCs for Tiptronic Switch -F189-
			Cruise control system characteristic map		244	Only for USA, not applicable yet

1) While driving, a second mechanic is required to read specifications.

01-201

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
002	2	Throttle valve value	While standing	idle	0...1 %	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily. - Perform electrical test ⇒ page 01-273 - See respective DTCs of Throttle Position (TP) sensor -G69-
				Wide Open Throttle (WOT)	99...100 %	
	3	Transmission Vehicle Speed (VSS) sensor -G38- 2)	While driving 1)		0...8200	- See appropriate DTC for VSS -G38- (-G195-) 2) - See display group number 001
	4	Gear selected	See display group number 1, display field 4			

1) While driving, a second mechanic is required to read specifications.

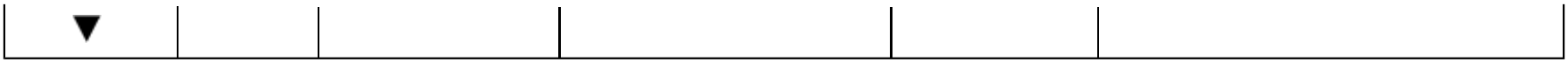
2) Also referred to as sensor for transmission output RPM -G195-.

01-202

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
003	1	Brake light switch -F-		Brake not operated	-	- See appropriate DTCs for brake light switch -F-
				Brake activated	Brake	- Perform electrical test ⇒ page 01-273
	2	Shift lock solenoid -N110- 2)	While standing	brake not operated	P N active	- See appropriate DTC for shift lock solenoid -N110- 2)
				brake activated	P N not selected	- Check shift lock solenoid -N110-. Perform electrical test ⇒ page 01-273
	3	Speed	While driving 1)		...km/h	Speedometer display and value on V.A.G1551 may deviate slightly from each other. - If necessary, check Speedometer Vehicle Speed sensor (VSS) -G22-

Continue



1) While driving, a second mechanic is required to read specifications.

2) Shift lock solenoid -N110- is also referred to as shift lock ⇒ solenoid -N110-.

01-203

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
003	4	Supply voltage, terminal 15	While standing	min.	10.0 V	- Perform electrical test ⇒ page 01-273 - See DTC table, DTC 00532 ⇒ page 01-45
				max.	16.0 V	
004 Continue ▼	1	ATF temperature	While standing with engine running.		... °C	- Perform electrical test ⇒ page 01-273 - See appropriate DTCs for Transmission Fluid (ATF) Temperature sensor -G93-

Notes for ATF temperature:

- *Recognized temperature of minus 50° C indicates a short circuit to Ground (GND)*

- *Recognized temperature of minus 180° C indicates a short circuit to B+ or an open circuit*

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
004	2	Selector lever position - (Multi-function Transmission Range (TR) switch -F125-)	While standing	P	P	- Check TR switch -F125-. Display group no. 004
			Selector	R	R	- Perform electrical test ⇒ page 01-273
			lever	N	N	Check for agreement with indication in instrument cluster
			in	D	D	
				4	4	
				3	3	- If necessary adjust selector lever bowden cable
				2	2	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37, shift mechanism, repairing*

Continue ▼

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
004	3	Multi-function Transmission Range (TR) switch -F125-	while standing	Selector lever position	L1 L2 L3 L4	- See appropriate DTC for TR switch -F125- 1)
				P	1000	- Check TR switch -F125-
				R	0100	- Perform electrical test ⇒ page 01-273
				N	1110	
				D	1011	- If necessary adjust selector lever bowden cable
				4	0111	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37, shift mechanism, repairing*
Continue ▼				3	0001	
				2	0010	

01-206

Notes for display field 3 of display group number 004:

- *Input signals of Multi-function Transmission Range (TR) switch -F125- can be checked at the Transmission Control Module (TCM).*

	Display field 3: (from left to right)			
	L 1	L 2	L 3	L 4
Wiring connection to TCM -J217-	Terminal 36 of -J217-	Terminal 8 of -J217-	Terminal 37 of -J217-	Terminal 9 of -J217-

01-207

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
004 without CAN-bus	4	Engine intervention (ignition intervention)	While driving [1] Engine speed signal OK		- See DTC table, DTC 00545, 18192 and 18193 ⇒ page 01-45
			is switched on	Engine interv.	- Perform electrical test ⇒ page 01-273 - Check wire connection to Engine Control Module (ECM)
			is switched off	-	- Only replace Transmission Control Module (TCM) -J217- if necessary ⇒ page 01-11

[1] While driving, a second mechanic is required to read specifications.

Notes for display field 4 of display group number 004 are on the next page:

01-208

Notes for display field 4 of display group number 004:

- *This display field 4 is only valid for vehicles without CAN-bus, refer to next page for vehicles with CAN-bus. A)*
- *Engine intervention is only activated during the shifting process. Depending on the driving situation, engine intervention may only be activated briefly, i.e. the relatively slow data transfer to the V.A.G1551 can miss this brief engine intervention under certain driving conditions.*

A) There is a distinction made between vehicles with and without CAN-bus. For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, unit allocation, ratios, equipment*

01-209

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
004 with CAN-bus	4	Information of On Board Diagnostic (OBD) Indicated on display from left to right	While driving [1]		not applicable
		Malfunction display	switched on	1	
			switched off	0	
		Trip	completed	1	
			not completed	0	
		Transmission warm-up	completed	1	
			not completed	0	
		Engine start	recognized	1	
			not recognized	0	

[1] While driving, a second mechanic is required to read specifications.

Notes for display field 4 of display group number 004 ⇒ ***see next page***

01-210

Notes for display field 4 of display group number 004:

- *This display field 4 is only valid for vehicles with CAN-bus, refer to previous display field 4 for vehicles without CAN-bus. A)*

A) There is a distinction made between vehicles with and without CAN-bus. For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, aggregate allocation, ratios, equipment*

01-211

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
005	1	Solenoid valve 1 -N88- 2)	while driving 1)	Gear selected		- See appropriate DTC for solenoid valve 1 -N88- 2)
				R, 5, 2, 1, 1M	1	
				3, 4	0	- Perform electrical test ⇒ page 01-273
	2	Solenoid valve 2 -N89- 3)	while driving 1)	Gear selected		- See appropriate DTC for solenoid valve 2 -N89- 3)
				3, 2, 1	1	
Continue ▼				R, 1M, 4, 5	0	- Perform electrical test ⇒ page 01-273

1) While driving, a second mechanic is required to read specifications.

2) Solenoid valve 1 -N88- is also referred to as shift valve 1 ⇒ solenoid valve 1 -N88-

3) Solenoid valve 2 -N89- is also referred to as shift valve 2 ⇒ solenoid valve 2 -N89-

01-212

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
005	3	Solenoid valve 3 -N90- 2)	While driving 1)	Gear selected		- See appropriate DTC for solenoid valve 3 -N90- 2)
				3, 4, 5	X	
				R, 1, 1M, 2	0	- Perform electrical test ⇒ page 01-273
	4	Gear selected	See display group number 1, display field 4			

1) While driving, a second mechanic is required to read specifications.

2) Solenoid valve 3 -N90- is also referred to as shift valve 3 ⇒ solenoid valve 3 -N90-

Notes for display group number 5, display field 1 to 3;

- *Un-switched solenoid valves are indicated with "0", switched solenoid valves are indicated with "1".*
- *Variable switching solenoid valves are indicated with "X".*

01-213

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
006	1	Specified current of solenoid valve 4 -N91- 2)	While driving 1)		- See DTC table, DTC 00264 ⇒ page 01-45
				min. 0.1 A	- Perform electrical test ⇒ page 01-273
				max. 0.8 A	
	2	Specified current of solenoid valve 5 -N92- 3)	While driving 1)		- See DTC table, DTC 266 ⇒ page 01-45
				min. 0.1 A	- Perform electrical test ⇒ page 01-273
Continue ▼				max. 0.8 A	

1) While driving, a second mechanic is required to read specifications.

2) Solenoid valve 4 -N91- is also referred to as pressure control valve 1 for auto. transmission -N215-.

3) Solenoid valve 5 -N92- is also referred to as pressure control valve 2 for auto. transmission -N216-.

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
006	3	Specified current of solenoid valve 6 -N93- 2)	While driving 1)		- See DTC table, DTC 268 ⇒ page 01-45
				min. 0.1 A	- Perform electrical test ⇒ page 01-273
				max. 0.8 A	
	4	Gear selected	See display group number 1, display field 4		

1) While driving, a second mechanic is required to read specifications.

2) Solenoid valve 6 -N93- is also referred to as pressure control valve 3 for auto. transmission -N217-.

Notes for specified current of solenoid valves:

- *Faulty solenoid valves or clutches or other malfunctions can prevent shifting into certain gears.*

01-215

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
007	1	ATF temperature	While standing with engine running. When temperature sensor is faulty, a replacement value is transmitted.		... ° C	- Check Transmission Fluid (ATF) Temperature sensor -G93-; perform electrical test ⇒ page 01-273
	2	Specified current of solenoid valve 7 -N94- 2)	While driving 1)	min.	0.1 A	- See DTC table, DTC 270 ⇒ page 01-45
				max	0.8 A	- Perform electrical test ⇒ page 01-273
	3	Torque converter lock-up clutch	While driving 1)		TC open	- See DTC table, DTC 1192 ⇒ page 01-45
					TC control	- Perform electrical test ⇒ page 01-273
Continue ▼					TC closed	

1) While driving, a second mechanic is required to read specifications.

2) Solenoid valve 7 -N94- is also referred to as pressure control valve 4 for auto. transmission -N218-.

01-216

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
007	4	Torque converter slip speed	hile driving 1)	TC open	0.....standstill RPM	- See DTC table, DTC 00297, 00660 and 01192 ⇒ page 01-45
				TC control (last shift operation at least 20 sec ago)	20...120 RPM	- Determine which element is faulty or not activated, transmission with shift elements ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37, transmission with shift elements*
				TC closed	0...10 RPM	- Check plausibility between engine, transmission input- and transmission speed; Display group number 001

1) While driving, a second mechanic is required to read specifications.

Notes for display field 4 of display group number 004 are on the next page:

01-217

Test requirements for torque converter slip speeds:

- *"TC closed": Shifting process must be complete (wait at least 1 sec.), the Torque Converter (TC) must be closed and the accelerator pedal value must be constant.*
- *"TC control": Indicated values are valid for the regulating condition of the throttle converter (control). Under inconvenient conditions (e.g. accelerating on a hill), this condition is not reached until 20 seconds after the shifting process has been completed. During this regulating phase, slip values of up to 350 RPM can be reached.*
- *Excessive torque slip speeds can also indicate slipping clutches or non-activated shifting elements.*

01-218

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
008	1	Kick down switch -F8-	Kick-down	activated	Kick down	- Check kick down switch, perform electrical test ⇒ page 01-273
				not operated	-	
	2	Throttle valve value [1)]	while standing	idle	0...1 %	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily.
				Wide Open Throttle (WOT)	99...100 %	- Perform electrical test ⇒ page 01-273 - See DTC table, DTC 00518 and 00638 ⇒ page 01-45

Continue ▼

01-219

Only for transmission with hydraulic control -E17-

Display group No.	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
008	3 [3] without CAN-bus	Throttle valve duty cycle	While standing, idle	smaller than 30%	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily.
			Wide Open Throttle (WOT)	more than 70%	- Perform electrical test ⇒ page 01-273 - See DTC table, DTC 00518 and 00638 ⇒ page 01-45
Continue ▼	3 [2] with CAN-bus	Engine torque	While driving [1]	Nm	The signal for actual engine torque is transmitted by the Engine Control Module (ECM) to the Transmission Control Module (TCM) via the CAN-bus wiring.

Notes and footnotes for display group number 008 are on the next page.

01-220

Only for transmission with hydraulic control E17

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G 1551 display	Corrective actions
008	4	Signal for deceleration/engine under load	While driving 1)	Deceleration mode	Deceleration	For declines or delay (engine brake)
				Engine under load	-	Engine is under load in normal driving conditions.

1) While driving, a second mechanic is required to read specifications.

2) Only for vehicles with CAN-bus For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, unit allocation, ratios, equipment*

3) Only for vehicles without CAN-bus For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, unit allocation, ratios, equipment*

01-221

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
009 with CAN-bus	1	Engine torque (actual)	while driving 1)	...Nm	The signal for actual engine torque is transmitted by the Engine Control Module (ECM) to the Transmission Control Module (TCM) via the CAN-bus wiring.
	2	Maximum torque	while driving 1)	...Nm	The engine torque required (reduced) by the TCM during the shifting process 2)
	3	Engine RPM	with engine running	approx. 0...8200 RPM	- See DTC table, DTC 529 and 543 ⇒ page 01-45
	4	Throttle valve value	while standing – Idle 1)	0...1 %	When accelerating from idle to WOT, %-value increases steadily. - See DTC table, DTC 518 ⇒ page 01-45
			while standing – Wide Open Throttle (WOT)	99...100 %	

Notes and footnotes for display group number 009 for vehicles with CAN-bus are on the next page.

01-222

1) While driving, a second mechanic is required to read specifications.

2) While driving in one gear, the indicated shifting torque remains constantly high, since no torque reduction is required.

Notes for display group number 009;

- *This display group number 009 is only valid for vehicles with CAN-bus, refer to display group number 009 on next page for vehicles without CAN-bus. A)*

A) There is a distinction made between vehicles with and without CAN-bus. For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, unit allocation, ratios, equipment*

01-223

Only for transmission with hydraulic control E17

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
009 without CAN-bus	1	Engine torque (actual)	While driving [1)]	Nm	Engine torque is calculated by the Transmission Control Module (TCM) based on fuel consumption signal and engine speed signal.
	2	Engine RPM	With engine running	approx. 0...8200 RPM	- See DTC table, DTC 529 and 543 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
	3	Throttle valve value	See display group number 2, display field 2		
	4	Fuel consumption signal (high time)	While driving [1)]	ms	Not applicable

[1)] While driving a second mechanic is required to read specifications.

Notes for display group number 009 ⇒ see next page;

01-224

Notes for display group number 009;

- *This display group number 009 is only valid for vehicles without CAN-bus, refer to previous display group number 009 for vehicles with CAN-bus. A)*

- *For vehicles with motronic injection and ignition systems, engine torque is transmitted by the Engine Control Module (ECM). For these vehicles, the fuel consumption display is omitted or always indicates "00ms".*

A) There is a distinction made between vehicles with and without CAN-bus. For information on which vehicles are equipped with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00, engine codes, aggregate allocation, ratios, equipment*

01-225

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
010	1	Torque increase in torque converter	While driving [1]	1...2,17	Calculated by the Transmission Control Module (TCM) from the torque converter slip speed
	2	Engine speed (RPM)	With engine running	approx. 0...8200 RPM	- Perform electrical test ⇒ page 01-273 - See DTC table, DTC 529 and 543 ⇒ page 01-45
	3	Gear selected	See display group number 1, display field 4		
	4	Anti-Slip Regulation (ASR)	While driving [1] activated	ASR active	Only activated by the ASR control module when necessary
			not activated	-	

[1] While driving, a second mechanic is required to read specifications.

01-226

Only for transmission with hydraulic control -E17-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G 1551 display	Corrective actions
011	1	Selector lever position	See display group number 004, display field 2		
	2	Tiptronic Switch - F189-	Selector lever in tiptronic gate	M switch	- Perform electrical test ⇒ from page 01-273
			Selector lever not in tiptronic gate	-	
	3	Tiptronic Switch - F189-	Selector lever in tiptronic gate, select gears		- Perform electrical test ⇒ from page 01-273
			Shift up 3)	Up switch	
			Shift down 2)	Down switch	
	4	Air conditioning kick down	While driving 1) activated	Comp. OFF	A/C compressor switch-off is only activated following kick-down for down-shift
			not activated	Comp. ON	

Notes and footnotes for display group number 11 are on the next page.

01-227

1) While driving, a second mechanic is required to read specifications.

2) Operate down-switch (-) by shifting selector lever toward rear. For vehicles equipped with a tiptronic sport steering wheel, down switch must also be operated by pressing the lower left or right button (-) on the steering wheel in order to check it's function.

3) Operate up-switch (+) by shifting selector lever toward front. For vehicles equipped with a tiptronic sport steering wheel, up-switch must also be operated by pressing the upper left or right button (+) on the steering wheel in order to check it's function.

Read Measuring Value Block (scan tool function 08) for transmissions with hydraulic control -E18/2-

Notes:

For transmissions with hydraulic control -E17-, "Read Measuring Value Block" can be found ⇒ page 01-187

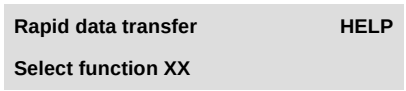
CAUTION!

To avoid risk of accidents during measuring and test drives, note safety precautions ⇒ page 01-34 .

Procedure

- Connect VAS 5051 tester or V.A.G 1551 scan tool and select Transmission Control Module (TCM) using "address word" 02 ⇒ page 01-36 .

  Ignition must remain switched on for this procedure.



Indicated on display

- Press PRINT button to turn on Scan Tool (ST) printer. Indicator lamp in button must light up.

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read measuring value block **Q**

Input display group number XXX

When indicated on display:

- Enter desired display group number ⇒ page 01-230 display group overview.
- Confirm input using the -Q- button.

Read measuring value block 1 →

1 2 3 4

Indicated on display (example) for display group 001:

Notes:

- *Explanation of values in individual display fields test table ⇒ page 01-234 .*
- *Display can be printed out when printer is switched on.*
- *To switch to a different display group, proceed as follows:*

Display group	V.A.G 1551	VAS5051 tester
Higher	Press button -3-	Press ▲ button.
Lower	Press button -1-	Press ▼ button.

- If specified values are obtained in all display fields, press → button.

Rapid data transfer **HELP**

Select function XX

Indicated on display (function selection):

01-230

Overview of selectable display group numbers for transmission with hydraulic control -E18/2-

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 1 → **0 RPM 0 RPM 0 RPM 4**	001	1 2 3 4	Engine speed (RPM) Sensor for transmission RPM -G182- Sensor for transmission output RPM -G195- Gear selected
Read measuring value block 2 → **DS 0 % 0 RPM 4**	002	1 2 3 4	Actual program Throttle valve value or accelerator pedal position Sensor for transmission output RPM -G195- Gear selected
Read measuring value block 3 → **PN active 0 km/h 12.8 V**	003	1 2 3 4	Brake light switch "P" "N" lock Speed Voltage supply

Read measuring value block 4 →	004	1	ATF temperature
		2	Selector lever position
21.0 ° C P 1000 0101		3	Multi-function switch position
		4	Information of On Board Diagnostic (OBD)

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 5 → **0 0 0 4**	005	1 2 3 4	Solenoid valve 1 -N88- Solenoid valve 2 -N89- Solenoid valve 3 -N90- Gear selected
Read measuring value block 6 → **0.747 A 0.747 A 0.747 A 0**	006	1 2 3 4	Specified current of Pressure Control Valve 1 for auto. transmission -N215- Specified current of Pressure Control Valve 2 for auto. transmission -N216- Specified current of Pressure Control Valve 3 for auto. transmission -N217- not applicable
Read measuring value block 7 →	007	1	ATF temperature

21.0° C 0.747 A TC on 0 RPM		2 3 4	Specified current of Pressure Control Valve 4 for auto. transmission -N218- Torque converter lock-up clutch Torque converter slip speed
Read measuring value block 8 → **0 % Deceleration**	008	1 2 3 4	Kick down switch Throttle valve value or accelerator pedal position Deceleration mode/engine under load

Indicated on display (example)			
Display fields: **1 2 3 4** | | | |	**Display group no.**	**Display field**	**Description**
Read measuring value block 9 → **100 Nm 0 RPM 0 %**	009	1 2 3 4	Engine torque (actual) Engine speed (RPM) Throttle valve value or accelerator pedal position
Read measuring value block 10 → **0.00 0 RPM 4**	010	1 2 3 4	Torque increase in torque converter Engine speed (RPM) Gear selected
Read measuring value block 11 → **D M-switch up-switch**	011	1 2 3 4	Selector lever position Tiptronic recognition Tiptronic Switch -F189-

Read measuring value block 12 → **E 56 80 45**	012	1 2 3 4	Type of drive, load Dynamic code number Drive resistance index Driver evaluation
Read measuring value block 125 → **1 0**	125	1 2 3 4	Reception of engine messages via CAN-bus Reception of ABS messages via CAN-bus

01-233

Notes:

- *When the printer is switched on, the contents of the display will be printed out .*
- *If specified values are not obtained in all display fields:*

- Press → button.

Rapid data transfer **HELP** **Select function XX**	Indicated on display

01-234

Test table for transmissions with hydraulic control -E18/2-

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
001	1	Engine RPM	With engine running	approx. 0...8200 RPM	- See DTC table, DTC 17968 / P1560 ⇒ page 01-45
	2	Sensor for transmission RPM -G182-	While driving, with gear selected[1)]	RPM	- See DTC table, DTC number 17100 / P0716 ⇒ page 01-45
			R	approx. 0...8200	
			1. 1m	approx. 0...2000	- Read measuring value block, display group number 006 or 007 and determine which elements are faulty or not activated while driving
Continue ▼			2	approx. 0...8200	
			3	approx. 0...8200	

1) While driving, a second mechanic is required to read specifications.

01-235

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
001	2		While driving[1)]	With gear selected	RPM	- See previous page
				4	approx. 0...8200	
				5	approx. 0...8200	
	3	Sensor for transmission output RPM -G195-	While driving, with gear selected[1)]		RPM	- See DTC table, DTC number 17105 / P0721 ⇒ page 01-45
				R	approx. 0...2000	
				1. 1m	approx. 0...2000	- Read measuring value block, display group number 006 or 007
Continued				2	approx. 0...4000	- Determine while driving which elements are faulty and which aren't active
▼				3	approx. 0...5800	

[1)] While driving, a second mechanic is required to read specifications.

01-236

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
Continued ▼			4	approx. 0...8200	
			5	approx. 0...8200	

Notes for display group number 001, display field 1 to 3;

- *Test conditions: Shifting process must be finished. Vehicle must not be in deceleration mode (no decline driving or engine brake).*

01-237

Display group number	Display field	Description	Test requirements		Specification for display on V.A.G1551	Corrective actions
001	4	Gear selected	While driving[1)]	Selector lever position		- Check solenoid valves. See display group numbers 005, 006 and 007 - See DTC table, DTC of respective solenoid valves ⇒ page 01-45 - Check selector lever position. Display group number 004
				"N"	"1"..."5"[2)]	
				"R"	"R"	
				"D"	"1m" "2" "3" "4" "5"	
				"4"	"1m" "2" "3" "4"	
				"3"	"1m" "2" "3"	
				"2"	"1m" "2"	

1) While driving, a second mechanic is required to read specifications.

2) Transmission Control Module (TCM) is equipped with an automatic gear follower. The forward gear is indicated that the TCM would activate in selector lever position "D".

Notes for display field 4 of display group number 001:

- *Faulty solenoid valves or other DTCs can prevent the selection of certain gears.*

01-238

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
002	1	Actual program	In normal driving conditions [1)]		Determined by driving style and street conditions (acceleration, accelerator pedal movement, speed and load)
			Dynamic shift program is active	DS	Shifting avoided whenever possible
			Warm-up program is active	WL	Up-shifting occurs faster to avoid high RPM.
			Anti-Slip Regulation (ASR) active	AS	- Check display group number 004
Continue ▼			Tiptronic recognition activated	TT	- See DTC table, DTC 18141/P1733 to 18152/P1744 ⇒ page 01-45

[1)] While driving, a second mechanic is required to read specifications.

01-239

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
002	2	Throttle valve value or value from accelerator pedal position	While standing	Idle	0...1 %	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily. - Perform electrical test ⇒ page 01-273 - See DTC table, DTC 18269 / P1861 ⇒ page 01-45
				Wide Open Throttle (WOT)	99...100 %	
	3	Sensor for transmission output RPM -G195-	While driving [1)]		0...8200	- See DTC table, DTC number 17105 / P0721 ⇒ page 01-45 - See display group number 001
	4	Gear selected	See display group number 1, display field 4			

[1)] While driving, a second mechanic is required to read specifications.

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
003	1	Brake light switch -F-		activated	Brake	- See DTC table, DTC 17087 / P0703 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
				not activated	-	
	2	Shift lock solenoid -N110-	While standing in P, N	Brake not operated	P N active	- See DTC table, DTC 18170/P1762 and 18196 / P1761 ⇒ page 01-45 - Check shift lock solenoid -N110-. Perform electrical test ⇒ page 01-273
				Brake activated	P N not selected	

Continue ▼

01-241

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
003	3	Speed	While driving [1]	km/h	- If necessary, check speedometer vehicle speed sensor (VSS) -G22-
	4	Supply voltage, terminal 15	While standing min.	10.0 V	- Perform electrical test ⇒ page 01-273
			max.	16.0 V	- See DTC table, DTC 18158/P1750 and 18159 / P1751 ⇒ page 01-45

[1] While driving, a second mechanic is required to read specifications.

Note for display field 3, speed:

Display of the speedometer and values at VAS 5051 or V.A.G 1551 may deviate slightly from each other.

01-242

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
004 Continue ▼	1	ATF temperature	While standing with engine running	°C	- Perform electrical test ⇒ page 01-273 - See DTC table, DTCs 17094 / P0710, 17095 / P0711, 17096 / P0712 and 17097 / P0713 ⇒ page 01-45

Notes for ATF temperature:

- *Temperature of minus 50° C indicates a short circuit to Ground (GND),*
- *Temperature of minus 180° C indicates a short circuit to B+ or an open circuit,*

01-243

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
004	2	Selector lever position (Multi-function Transmission Range (TR) switch -F125-	While standing	P	P	
			Selector	R	R	
			lever	N	N	Check for agreement with indication in instrument cluster
			in	D	D	- Check display field 3
				4	4	
				3	3	
				2	2	
	Continue ▼					

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
004	2 [1)]	Selector lever position - (Multi-function Transmission Range (TR) switch -F125-)	While standing, selector lever between	P and R or R and D	Z1	- Check multi-function Transmission Range (TR) switch -F125-. display group number 004, display field 3
		Between positions at selector lever mechanism		N and D	Z2	- Perform electrical test ⇒ page 01-273
				D and 4	Z3	- If necessary adjust selector lever bowden cable
Continue ▼				4 and 3 or 3 and	Z4	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37,* shift mechanism, repairing, selector lever cable, checking and adjusting

				2		

1) This display field is not displayed until model year 2000 (May 1999)

Note on in-between positions:

When the selector lever is shifted into one of the in-between positions, the Scan Tool indicates "Z1", "Z2", "Z3" or "Z4". Display in instrument cluster must not indicate a gear selected, i.e. PRND432 is indicated without any particular gear highlighted.

01-245

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
004	3	Multi-function Transmission Range (TR) switch -F125-	While standing	Selector lever position	L1 L2 L3 L4	- See DTC table, DTC 17090 / P0706 ⇒ page 01-45
				P	1000	- Check multi-function Transmission Range (TR) switch -F125-
				R	0100	- Perform electrical test ⇒ page 01-273
				N	1110	
				D	1011	- If necessary adjust selector lever bowden cable
				4	0111	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37, shift mechanism, repairing*
Continue ▼				3	0001	
				2	0010	

01-246

Notes for display field 3 of display group number 004:

- *The input signals of the Multi-function Transmission Range (TR) switch -F125- can be checked at the Transmission Control Module (TCM).*

	Display field 3: (from left to right)			
	L 1	L 2	L 3	L 4
Wiring connection to Transmission Control Module (TCM) -J217-	Terminal 36 of -J217-	Terminal 8 of -J217-	Terminal 37 of -J217-	Terminal 9 of -J217-

01-247

Display group number	Display field	Description	Test requirements	Spec, value on V.A.G1551 display	Corrective actions
004	4	Information of On Board Diagnostic (OBD) Indicated on display from left to right	While driving [1]		Not applicable
		Malfunction display	Switched on	1	
			Switched off	0	
		Trip	Completed	1	
			Not completed	0	
		Transmission warm-up	Completed	1	
			Not completed	0	
		Engine start	Recognized	1	
			Not recognized	0	

[1] While driving, a second mechanic is required to read specifications.

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
005	1	Solenoid valve 1 -N88-	While driving[1)]	Gear selected		- Check whether display is the same as on shift lever display
				R. N, D, (1 and 2 (1 gear), Shift-down from 5 to 4 gear	X	
				D (3 and 4 gear)	0	- Perform electrical test ⇒ page 01-273
Continue ▼	2	Solenoid valve 2 -N89-	While driving[1)]	Gear selected		
				N, D (1, 2 and 3 gear)	X	- Perform electrical test ⇒ page 01-273
				R, D (4 and 5 gear) D, down-shift 5 to 4	0	

1) While driving, a second mechanic is required to read specifications.

Notes for display group number 5, display field 1 to 3;

- *Unswitched solenoid valves (inactive) are indicated with "0", switched solenoid valves (active) are indicated with "1".*

01-249

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
005	3	Solenoid valve 3 -N90-	While driving[1)]	Gear selected		- See DTC table, DTC 17145/P0761, 17146/P0762 and 17147/P0763 ⇒ page 01-45
				D (down-shift 5 to 4 gear)	X	
				D (3, 4. and 5 gear)	x or 0 [2)]	- Perform electrical test ⇒ page 01-273
				R, N, D (1 and 2 gear) 2 (1 gear)	0	
	4	Gear selected	See display group number 001, display field 4			

1) While driving, a second mechanic is required to read specifications.

2) The solenoid valve is switched momentarily while driving, meaning that the mode changes from display "0" to "X" and then again to "0". This switching in these gears is not relevant.

Notes for display group number 5, display field 1 to 3;

- *Unswitched solenoid valves (inactive) are indicated with "0", switched solenoid valves (active) are indicated with "1".*

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
006	1	Specified current of Pressure Control Valve 1 for auto. transmission -N215-	While driving[1)]		- See DTC table, DTC 18222/P1814 and 18223 / P1815 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
				min. 0.0 A	
				max. 2.0 A	
	2	Specified current of Pressure Control Valve 2 for auto. transmission -N216-	While driving[1)]		- See DTC table, DTC 18227/P1819 and 18228 / P1820 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
				min. 0.0 A	
Continue ▼				max. 2.0 A	

[1)] While driving, a second mechanic is required to read specifications.

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
006	3	Specified current of Pressure Control Valve 3 for auto. transmission -N217-	While driving[1)]		- See DTC table, DTC 18232/P1824 and 18233 / P1825 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
				min. 0.0 A	
				max. 2.0 A	
	4				Not yet applicable

1) While driving, a second mechanic is required to read specifications.

Notes for specified current of solenoid valves:

- *Faulty solenoid valves or pressure control valves or clutches or other malfunctions can prevent shifting into a specific gear.*

01-252

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
007	1	ATF temperature	See display group number 1, display field 4			
	2	Specified current of Pressure Control Valve 4 for auto. transmission -N218-	While driving[1)]	min.	0.0 A	- See DTC table, DTC 18237/P1829 and 18238 / P1830 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
				max	2.0 A	
	3	Torque converter (TC) lock-up clutch	While driving[1)]		TC open	- See DTC table, DTC 17125 / P0741 ⇒ page 01-45 - Perform electrical test ⇒ page 01-273
Continue ▼					TC control	
					TC closed	

[1)] While driving, a second mechanic is required to read specifications.

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
007	4	Torque converter (TC) slip speed	While driving[1)]	TC open	0.....standstill RPM	- Check ATF oil level ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37,* - See DTC table, DTC number 17105 / P0721 and 17125/P0741 ⇒ page 01-45
				TC control (last shift process at least 20 seconds ago)	20...120 RPM	- Determine which element is faulty or not activated, transmission with shift elements ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37,*
				TC closed	0...20 RPM	- Check plausibility between engine RPM, transmission input RPM and transmission RPM, display group number 001

[1)] While driving, a second mechanic is required to read specifications.

Note:

- *Test requirements for torque converter slip speeds ⇒ next page*

01-254

Test requirements for torque converter slip speeds:

- *"TC closed": Shifting process must be complete (wait at least 1 sec.), the Torque Converter (TC) must be closed and the accelerator pedal value must be constant.*
- *"TC control": Indicated values are valid for the "regulating condition" of the throttle converter (control). Under inconvenient conditions (e.g. accelerating on a hill), this condition is not reached until 20 seconds after the shifting process has been completed. During this regulating phase, slip values of up to 350 RPM can be reached.*
- *Excessive torque slip speeds can also indicate slipping clutches or non-activated shifting elements.*

01-255

Display group number	Display field	Description	Test requirements		Spec. value on V.A.G1551 display	Corrective actions
008	1	Kick down switch -F8-	Kick-down	operated [2]	Kick-down	- Check kick-down switch, perform electrical test ⇒ page 01-273
				not operated	-	
	2	Throttle valve value or value from accelerator pedal position	While standing	idle	0...1 %	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily. - See DTC table, DTC 18269 / P1861 ⇒ page 01-45 - See also display group number 002, display field 2
				Wide Open Throttle (WOT)	99...100 %	
	3	Signal for deceleration/engine under load	While driving[1]	Deceleration mode	Deceleration	For down-hill or delay (engine braking)
				Engine under load	-	Engine is under load during normal driving conditions.

1) While driving, a second mechanic is required to read specifications.

2) Operate kick-down means that the accelerator pedal needs to be depressed to stop. Display must simultaneously indicate "100%" in display field 2.

01-256

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
009	1	Engine torque 2)	While driving 1)	Nm	- See DTC table, DTC 18265 / P1857 ⇒ page 01-45
Continue ▼	2	Engine RPM	With engine running	approx. 0...8200 RPM	- See DTC table, DTC 17968 / P1560 ⇒ page 01-45

1) While driving, a second mechanic is required to read specifications.

2) While driving in one gear, the indicated shift torque remains constantly high, since no engine torque reduction is required.

Note for display field 1:

The signal for actual engine torque is transmitted by the Engine Control Module (ECM) to the Transmission Control Module (TCM) via the CAN-bus wiring.

01-257

Display group number	Display field	Description	Test requirements		Spec. value V.A.G1551 display	Corrective actions
009	3	Throttle valve value or value from accelerator pedal position	While standing	idle	0...1 %	When accelerating from idle to Wide Open Throttle (WOT), %-value increases steadily. - See DTC table, DTC 18269 / P1861 ⇒ page 01-45 - See also display group number 002, display field 2
				Wide Open Throttle (WOT)	99...100 %	
	4 [2]	Transmission input torque	While driving[1]		Nm	Should be like display field 1.

[1] While driving, a second mechanic is required to read specifications.

[2] This display field is not displayed until model year 2000 (May 1999)

01-258

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
010	1	Torque increase in torque converter	While driving [1]	0...3.2	Calculated by the Transmission Control Module (TCM) from the torque converter slip speed
	2	Engine speed (RPM)	With engine running	approx. 0...8200 RPM	- See DTC table, DTC 17968 / P1560 ⇒ page 01-45
	3	Gear selected	See display group number 1, display field 4		
	4 [2]	Vehicle acceleration (actual)	While driving[1] Min.	-10 m/s2	

[1] While driving, a second mechanic is required to read specifications.

[2] This display field is not displayed until model year 2000 (May 1999)

01-259

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
011	1	Selector lever position	See display group number 4, display field 2		
	2	Tiptronic Switch - F189-	Selector lever in tiptronic gate	M-shift	- Perform electrical test ⇒ page 01-273
			Selector lever not in tiptronic gate	-	
	3	Tiptronic Switch - F189- (up/down shift)	Selector lever in tiptronic gate, select gears		- Perform electrical test ⇒ page 01-273
			Shift up 1)	Up-shift	
			Shift down 2)	Down-shift	

1) Operate up-shift (+) by shifting selector lever toward front. For vehicles equipped with a tiptronic sport steering wheel, up-shift must also be operated by pressing the upper left or right button (+) on the steering wheel.

2) Operate down-shift (-) by shifting selector lever toward rear. For vehicles equipped with a tiptronic sport steering wheel, down-shift must also be operated by pressing the lower left or right button (-) on the steering wheel.

01-260

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
012	1	Type of drive, load	Driving without load, e.g. driving on flat surface	E	not yet applicable
			Driving under load, e.g. uphill driving	B	
	2	Dynamic code number	Calculated from drive resistance index and driver evaluation	0...256	
	3	Drive resistance index	Necessary for calculation of dynamic code number	0...256	
	4	Driver evaluation	Necessary for calculation of dynamic code number	0...256	

01-261

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
013 [1)]	1	CAN-bus normalizing torque	While standing with ignition switched on	Nm	
	2	CAN-bus engine code		0 ... 63	- See DTC table, DTC 18157/P1749 and 18249 / P1841 ⇒ page 01-45
	3	CAN-bus Transmission code		1	- Check coding of Engine Control Module (ECM)
	4	CAN-bus software version code		0 ... 63	- See DTC table, DTC 18263 / P1855 ⇒ page 01-45

1) This display group number is not displayed until model year 2000 (May 1999)

Notes for display group number 013;

- *Display field 2 and 4: When replacing the ECM, the same indication that appeared for the old control module should appear after installation. If this is not the case, the wrong ECM was installed, or it is wrongly coded.*

01-262

Display group number	Display field	Description	Test requirements	Spec. value on V.A.G1551 display	Corrective actions
125	1	Reception of an engine message via the CAN-bus	While driving [1)] Received	1	- See DTC table, DTC 18258 / P1850 ⇒ page 01-45
			Not received	0 [2)]	- Perform electrical test ⇒ page 01-273
	2	Reception of an ABS message via the CAN-bus	While driving [1)] Received	1	- See DTC table, DTC 18259 / P1851 ⇒ page 01-45
			Not received	0 [2)]	- Perform electrical test ⇒ page 01-273

[1)] While driving, a second mechanic is required to read specifications.

[2)] If "0" is shown and there are no DTCs stored in memory, the relevant control module is not CAN capable (or is faulty).

01-263

CAN-bus, function

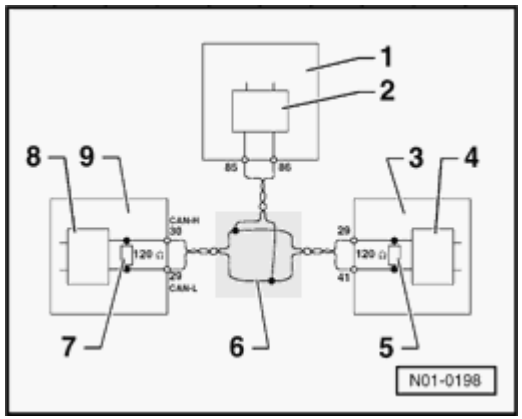
Bus:

The term "bus" refers to a system that transports and distributes data.

CAN:

The Controller Area Network is a bus system that uses two wires. These are called bus wires. Data is transferred to the connected control modules serial (one after the other) across the bus wires.

These control modules communicate with each other via the CAN-bus.



Overview of power train data-BUS

1 - Transmission Control Module (TCM) -J217-

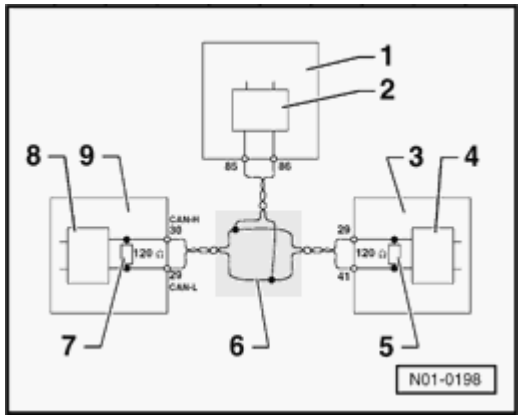
2 - Driver for BUS

3 - Motronic Engine Control Module (ECM) -J220-

4 - Driver for BUS

5 - Termination resistance

01-264



6 - Power train data-BUS (CAN-bus, twisted 2 line wire)

7 - Termination resistance

8 - Driver for BUS

9 - ABS Control Module -J104-

01-265

Two-wire bus system, checking

If the DTC table indicates to check the bus:

- Use the applicable wiring diagram, determine how many control modules communicate with each other via the bus.

- Press the -0- button twice to select the function "Automatic test sequence".

- Before checking the bus wires, make sure that none of the control modules connected are malfunctioning.

  A malfunction will disrupt communication to other control modules.

Is there a malfunction?

- Fix the malfunction before proceeding.

- Note malfunction and erase DTC memory of all control modules ⇒Checking and erasing DTC memory of the relevant control module.

- Press buttons -0- and -6- to select "End Output" function 06. Press -Q- button to confirm input.

- End output of scan tool by selecting the function "end output" ⇒ page 01-42 .

- Refer to the DTC table in the applicable repair manual for help in repairing the malfunction.

When necessary repairs have made:

- Check bus wires if communication to the control modules is still faulty. If yes, check bus wires.

There can be two situations:

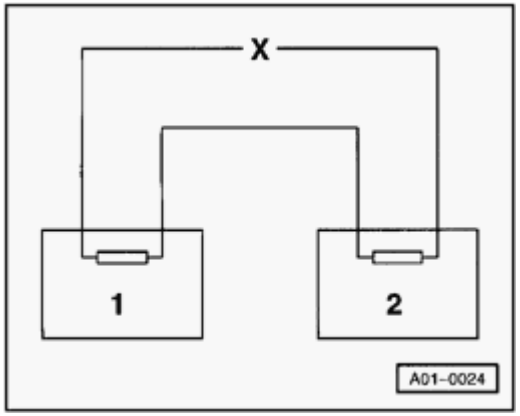
- Two control modules communicate via a "two-line bus system"

- Three or more control modules communicate via a "two-line bus system"

01-267

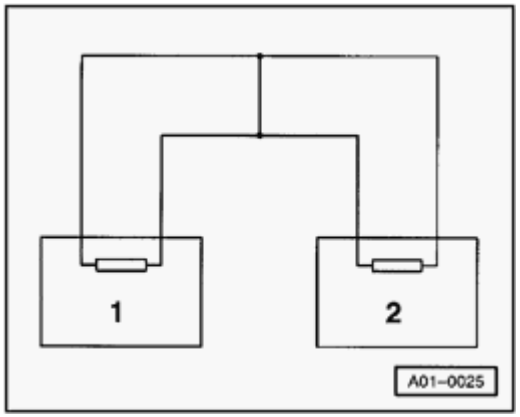
Two control modules communicate via a "two-line bus system"

- Switch ignition off.



- Disconnect both control modules.
- Check bus wires for open circuit.

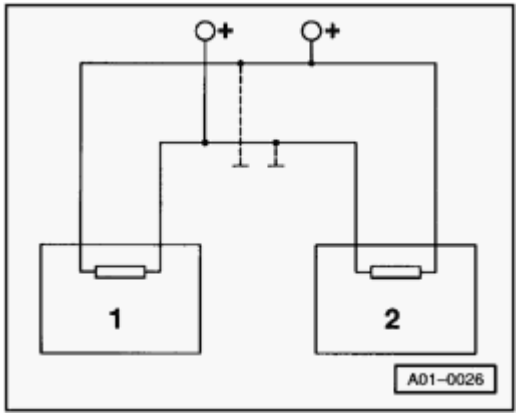
⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check whether there is a short circuit between bus wires.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

01-268



- Check bus wires for short circuit to B+ or Ground (GND).

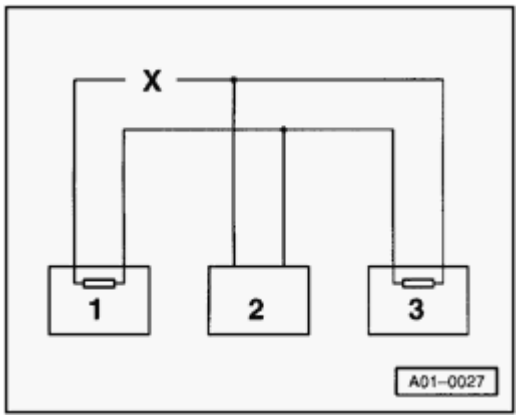
If there are no malfunctions in the bus wires:

- As a test, replace one of the control modules. Select a control module that will take the least amount of time to replace and cost the least amount of money.
- If communication between the control modules across the bus is still interrupted, replace the second control module.

01-269

Three or more control modules are communicating across a "two-line bus system"

- Analyze DTCs stored in the memories of the control modules.



Example 1:

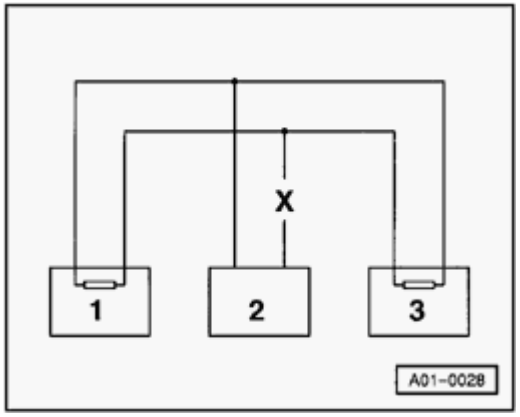
From the DTCs stored in the memories, determined that control module 1 is not communicating with control modules 2 and 3.

Control module	DTCs stored in DTC memories:
1	♦ Missing signal from control module 2 ♦ Missing signal from control module 3
2	♦ Missing signal from control module 1
3	♦ Missing signal from control module 1

- Switch ignition off.
- Disconnect the control modules connected across the bus wires and check bus wires for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Replace control module 1 if bus wires are OK.



Example 2:

From the DTCs stored in the memories, determined that control module 2 is not communicating with control modules 1 and 3.

Control module	DTCs stored in DTC memories:
1	♦ Missing signal from control module 2
2	♦ Missing signal from control module 1 ♦ Missing signal from control module 3
3	♦ Missing signal from control module 2

- Switch ignition off.
- Disconnect the control modules connected across the bus wires and check bus wires for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Replace control module 2 if bus wires are OK.

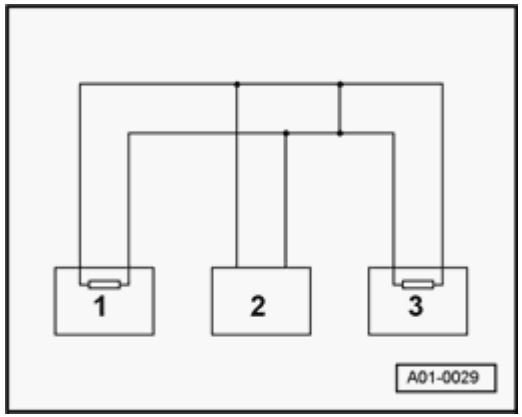
01-271

Example 3:

Using DTCs stored in the memories, determined that none of the control modules are sending or receiving signals.

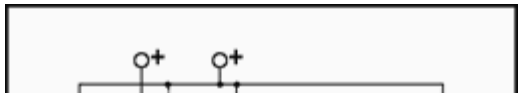
Control module	DTCs stored in DTC memories:
1	♦ Hardware faulty
2	♦ Hardware faulty
3	♦ Hardware faulty

- Switch ignition off.



- Disconnect the control modules connected across the bus wires and check for a short circuit between the bus wires.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*



- Check bus wires for short circuit to B+ or Ground (GND).

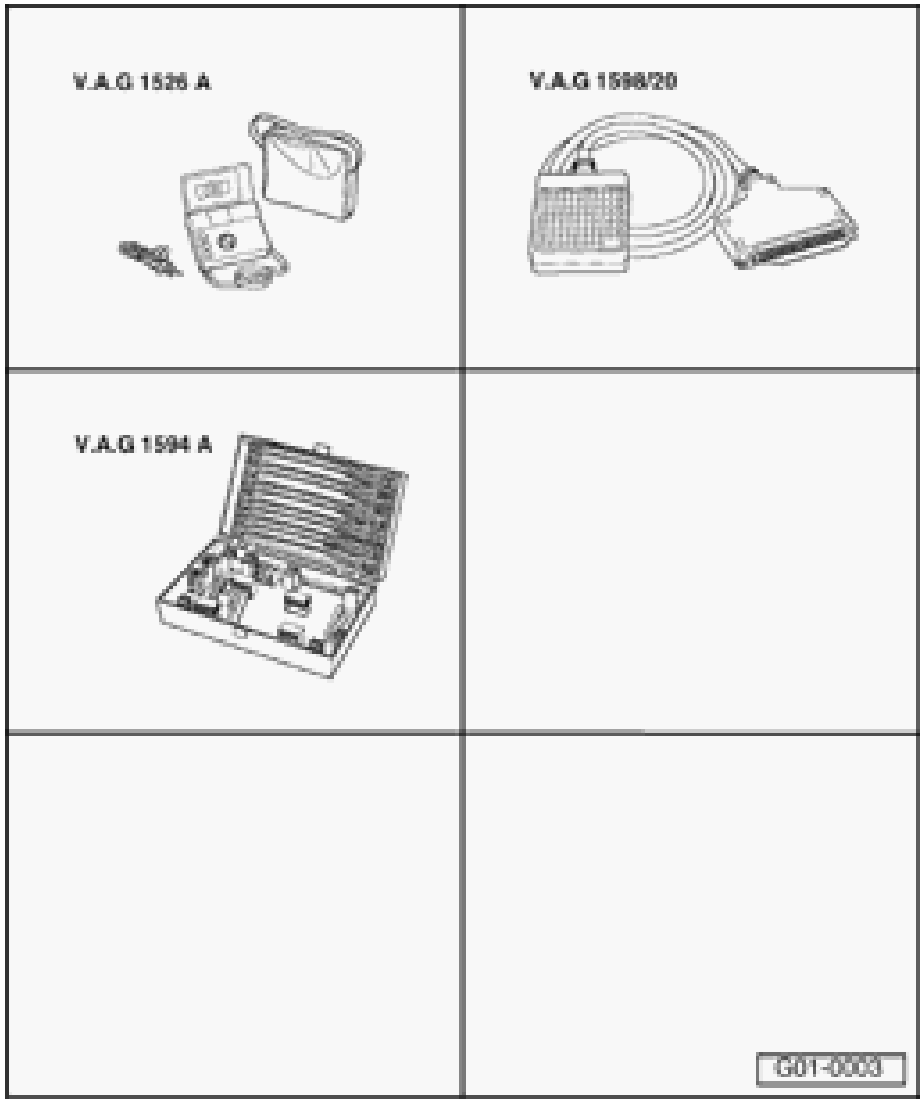
01-272

- If there are no malfunctions found in the bus wires, check whether one of the control modules is responsible for a short circuit of the bus wires to each other, to B+ or to Ground (GND).

  Disconnect each of the control modules connected via the bus wires one at a time and check whether the malfunction "Hardware faulty" has been eliminated.

  If it was eliminated, replace the control module that is currently disconnected. If malfunction was not eliminated, re-connect that control module and disconnect the next control module connected via the bus wires.

01-273



Electrical testing

Special tools and test equipment:

- VAG1526A multimeter
- VAG1598/20 test box
- VAG1594A connector test kit

01-274

Additional information

- Repair Manual, 5 Spd. Automatic Transmission 01V,
- Electrical Wiring Diagrams, Troubleshooting & Component Locations"

Notes:

- *Use VAG1526A multimeter for the test. The tables list which measures range needs to be selected before taking each measurement.*
- *The specified values are valid for an ambient temperature of 0 to 40° C (32 to 104° F).*
- *If the values obtained differ from the specified values, determine the malfunction using the applicable wiring diagram.*
- *If the measured values only deviate slightly from the specified values clean sockets and connectors of testers and repeat test. Before replacing a component, check wires and connections. If the specified values are below 10 Ω, repeat the resistance measurement on the component.*

- *Use VAG1598/20 adapter to connect test equipment.*

01-275

- *The contact numbers of the connector and the socket numbers of VAG 1598/20 test box match up ⇒ page 01-277 .*

- *To check the multi-function switch, it is not necessary to connect test box VAG 1598/20 because first the connectors for the multi-function switch are checked.*

CAUTION!

To avoid permanent damage of electronic components, select the appropriate measuring range on tester before connecting the measuring leads.

Test requirements

- Battery voltage OK

- Fuses for Transmission Control Module (TCM) OK

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Fuses for component being tested OK. The fuse holder is behind a cover on the side of

the instrument cluster.

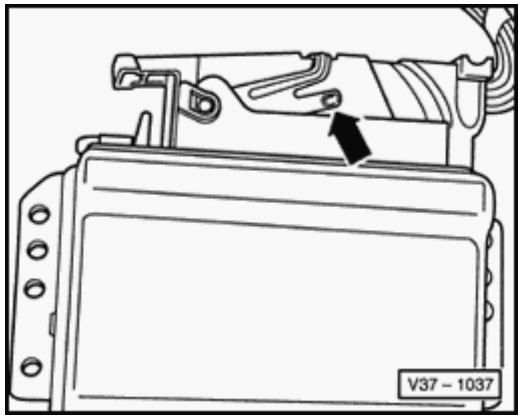
- Ground (GND) connections OK:

Check battery Ground (GND) strap and Ground (GND) strap between body and transmission.

Check Ground (GND) connections for Transmission Control Module (TCM).

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

01-276



- For all test steps, switch ignition off, disconnect multi-pin connector for Transmission Control Module (TCM) -J217- (located in front of passenger seat under carpet in foot well ⇒ page 01-11) and connect VAG1598/20 adapter to wiring harness connector.
- If measuring values do not match specifications, follow instructions in right-hand column of test table (labelled "Corrective action") ⇒ page 01-11 .
- Always perform all steps indicated in the "Corrective action" column.
- Only perform test steps recommended in the DTC table (selective troubleshooting).

01-277

88-pin connector for Transmission Control Module (TCM) -J217- (sockets on VAG1598/20)

1-	Solenoid valve 5 -N92-	18-	Kick-down switch -F8- (not for E-gas and V6-TDI)
2-	Shift lock solenoid -N110-	19-	Control input to transmission from ABS control module
3-	Vacant	20-	Engine intervention (via ignition timing) 1)
4-	Solenoid valve 7 -N94-	21-	ATF temperature sensor -G93-
5-	Solenoid valve 4 -N91-	22-	ATF temperature sensor -G93-
6-	Ground (GND) for power consumers, term. 31	23-	Sensor for transmission RPM -G182- (shielding)
7-	Vacant	24-	Vacant
8-	Multi-function TR switch -F125-, L2	25-	Selector lever display (not for Highline combi)
9-	Multi-function TR switch -F125-, L4 supply voltage for cruise control system	26-	Supply voltage (terminal 30) with or without fuses depending on model ⇒ wiring diagram
10-	Brake light switch -F- (not for E-gas and V6-TDI)	27-	Kick-down for air conditioning 1)
11-	Vacant	28-	Ground (GND) for electronics (terminal 31)4)
12-	Vacant	29-	Solenoid valve 6 -N93-

13- Tiptronic recognition	30- Solenoid valve 1 -N88-
14- Transmission VSS -G38-	31- Vacant
15- Transmission VSS -G38- (shielding)	32- Solenoid valve 3 -N90-
16- Sensor for transmission RPM -G182-	33- Solenoid valve 2 -N89-
17- Signal for malfunction monitor (OBD II - request) 1) 2)	34- Ground (GND) for power consumers (terminal 31)

01-278

35- Fuel consumption signal (engine torque, actual) 1)	54- Supply voltage (terminal 15)
36- Multi-function TR switch -F125-, L1	55- Supply voltage (terminal 15)
37- Multi-function TR switch -F125-, L3	56- Vacant
38- Vacant	-
39- Vacant	-
40- Engine speed (RPM) signal 1)	-
41- Throttle position value (load signal) 1)	-
42- Transmission VSS -G38-	-
43- Vacant	-
44- Sensor for transmission RPM -G182-	- Terminals 57 - 83 are vacant
45- Vacant	-
46- Tiptronic upshift switch	-
47- Tiptronic downshift switch	-
48- Vacant	-
49- Vacant	84- Vacant
50- Vacant	85- CAN-bus 3)
51- Upshift/downshift signal (for engine torque reduction)	86- CAN-bus 3)

52-	Supply voltage for solenoid valves	87-	Vacant
53-	Supply voltage for solenoid valves	88-	K-wire for On Board Diagnostic (OBD)

01-279

1) Only for vehicles without a CAN-bus.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

2) Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM) and can only be checked in read measured value block ⇒ page 01-186 .

3) Only for vehicles with a CAN-bus. Further information for CAN-BUS on the CAN-bus ⇒ page 01-263

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

4) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-280

List of test steps (88-pin connector)

- Only perform test steps for the relevant component, as listed in DTC and Read Measuring Value Block tables.

Item checked		Item checked	
Supply voltage for TCM -J217-	- Perform test steps 1 and 7	Solenoid valve 5 -N92- (Pressure control valve -2- -N216-)	- Perform test steps 13 and 8
Shift lock solenoid -N110-	- Perform steps 2, 6 and 16	Solenoid valve 6 -N93- (pressure control valve -3- -N217-)	- Perform test steps 14 and 8.
Brake light switch -F-	- Perform test step 3.	Solenoid valve 7 -N94- (pressure control valve -4- -N218-)	- Perform test steps 15 and 8.
Supply voltage for cruise control system	- Perform test step 4.	Transmission VSS -G38- (Sensor for transmission output RPM -G195-)	- Perform test step 18.
Kick-down switch -F8- (not for E-gas)	- Perform test steps 5 and 17	Sensor for transmission RPM -G182-	- Perform test step 19.
Multi-function TR switch (driving range sensor) -F125-	- ⇒ page 01-322	ATF temperature sensor -G93-	- Perform test step 20.
Solenoid valve 1 -N88-	- Perform test steps 8 and 9	Wiring connection to ECM[1)]	- Perform test steps 21, 22, 23, 24, and 25

[1)] Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM). Test is only for vehicles without CAN-bus.

Item checked		Item checked	
Solenoid valve 2 -N89-	- Perform test steps 10 and 8	Tiptronic switch -F189-	- Perform test steps 26 and 27
Solenoid valve 3 -N90-	- Perform test steps 11 and 8	CAN-bus 2)	- Perform test step 28 and check CAN-bus system ⇒ page 01-265 .
Solenoid valve 4 -N91- (Pressure control valve -1--N215-)	- Perform test steps 12 and 8		

2) Only for vehicles with CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

01-282

Electrical test table

Voltage measurement: Switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
1	55 + 6 55 + 6 54 + 28 1)	Supply voltage for Transmission Control Module (TCM) -J217-	• Ignition switched on	approx.battery voltage	- Check wiring per wiring diagram. - Check wiring from terminals 6, 34 and 28 to Ground - Check wiring from terminals 54 and 55 to terminal 15 of central electric.
	54 + 55			0 V	
	26 + 6 26 + 34	Voltage of electr. system (term. 30) for TCM -J217-	• Ignition switched off	approx. battery voltage	- Check wiring per wiring diagram.
2	2 + 6	Shift lock solenoid -N110- 2)	• Ignition switched on	approx. battery voltage	- Check wiring per wiring diagram. - Test multi-function TR switch -F125- for short circuit. - Test shift lock solenoid -N110- for short circuit.

					- Perform test steps 6 and 16

1) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

2) Solenoid for shift lock -N110- is also referred to as shift lock solenoid -N110-

01-283

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
3 [1)] not for E-gas engines	10 + 6 10 + 28[2)]	Brake light switch -F-	• Ignition switched on • Brake pedal not depressed	less than 1 V	- Check wiring per wiring diagram. - Replace and adjust brake light switch -F-. ⇒ *Repair Manual, Brake System, Repair Group 47*
			- Brake pedal depressed	approx. battery voltage	
4	9 + 6 9 + 28[2)]	Supply voltage for Cruise Control, Control Module -J213-	• Ignition switched on • Selector lever in D, 4 and 3	approx. battery voltage	- Check wiring from terminals 6 and 28 to Ground. - Check wiring from terminal 9 to terminal 15 of central electrics. - Check wiring to cruise control, control module -J213- - Check multi-function switch -F125- ⇒ page 01-322
			• Selector lever in P, R, N, and 2	less than 5 V	- Check fuse 31

1) This test cannot be performed on vehicles with E-gas. The signal is transmitted from brake light switch or brake test switch to Engine Control Module (ECM). The ECM then forwards the signal to the Transmission Control Module via the CAN-Bus.

2) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-284

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
5 [1)] not for E-gas engines	18 + 54	Kick-down switch -F8-	• Ignition switched on - Depress accelerator to kick-down	approx. battery voltage	- Check wiring per wiring diagram. - Adjust or replace accelerator pedal cable. ⇒ *Repair Manual, General, Engine, Repair Group 20* - Perform test step 17.

[1)] This test cannot be performed on vehicles with E-gas. The kick-down switch -F8- in this case is integrated in the Throttle Position (TP) Sensor (-G79-, -G185-).

01-285

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
6	2 + 54 2 +55	Shift Lock Solenoid -N110- [1)]	• Ignition switched off	14 to 28 Ω	- Check wiring per wiring diagram. - Check multi-function switch -F125- ⇒ Page 01-306 - Check Shift Lock Solenoid -N110- for short circuit - Perform test steps 2 and 16.

[1)] Solenoid for shift lock -N110- is also referred to as shift lock ⇒ solenoid -N110-

01-286

Resistance measurement: switch multimeter to 200 Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
7	6 + 34 28 [1] + 34	Ground (GND) connection of Transmission Control Module (TCM) -J217-	• Ignition switched off	smaller than 1 Ω	- Check wiring per wiring diagram.
	34 + battery ground (GND)		•	smaller than 1 Ω	
8	52 + 53	Voltage supply to solenoid valves	• Ignition switched off	smaller than 1,5 Ω	- Check wiring per wiring diagram. - Perform test step 1 - Check wiring between TCM and 16-pin connector ⇒ page 01-302 . - Perform test step 1 - Check harness in transmission according to wiring diagram

[1] Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-287

Resistance measurement: switch multimeter to 200 Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
9	52 + 30	Solenoid Valve 1 -N88-	• Ignition switched off	25 to 35 Ω	- Check 16-pin connector to transmission for contact corrosion - Perform test step 8
	30 + 34			infinity Ω 1)	
10	52 + 33	Solenoid Valve 2 -N89-	• Ignition switched off	25 to 35 Ω	- Check wiring connection from 88-pin connector to 8-pin connector ⇒ page 01-302 - Check wiring harness in transmission according to wiring diagram, replace if necessary. - Remove and install valve body ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*
	33 + 34			infinity Ω 1)	
11	52 + 32	Solenoid Valve 3 -N90-	• Ignition switched off	25 to 35 Ω	
	32 + 34			infinity Ω 1)	
12	52 + 5	Solenoid Valve 4 -N91-	• Ignition switched off	6 to 8 Ω	
	5 + 34			infinity Ω	

				1)	

1) Adjust VAG 1526 to highest resistance (Ω) range

01-288

Resistance measurement: switch multimeter to 200 Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
13	52 + 1	Solenoid valve 5 -N92- 2)	• Ignition switched off	6 - 8 Ω	- Check for contact corrosion on 16-pin connector to transmission. - Perform test step 8. - Check wiring between 88-pin connector for TCM and 8-pin connector ⇒ page 01-302 . - Check wiring harness in transmission according to current wiring diagram; replace if necessary. - Remove and install valve body ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*
	1 + 34			infinite Ω 1)	
14	52 + 29	Solenoid valve 6 -N93- 3)	• Ignition switched off	6 - 8 Ω	
	29 + 34			infinite Ω 1)	
15	52 + 4	Solenoid valve 7 -N94- 4)	• Ignition switched off	6 - 8 Ω	
	4 + 34			infinite Ω 1)	
1) Switch VAG1526 to highest resistance (Ω) measuring range.					
2) Solenoid Valve 5 -N92- is also called Pressure Valve 2 -N216-.					

3) Solenoid Valve 6 -N92- is also called Pressure Valve 3 -N217-.

4) Solenoid Valve 7 -N92- is also called Pressure Valve 4 -N218-.

01-289

Resistance measurement: switch multimeter to 200 Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
16	2 + 36	Shift lock solenoid -N110- 3)	• Ignition switched off - Selector lever in P	14 - 28 Ω	- Check wiring per wiring diagram. - Check Multi-function Transmission Range (TR) switch ⇒ page 01-306 - Perform test step 2 and 6 - Replace shift lock solenoid -N110-. ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*
17 2) not for E-gas engines	18 + 34	Kick-down switch -F8-	• Ignition switched off • Accelerator pedal not depressed	infinite Ω 1)	- Check wiring per wiring diagram. - Adjust or replace accelerator pedal cable. ⇒ *Repair Manual, General, Engine, Repair Group 20*
			- Depress accelerator pedal to kick-down.	less than 1.5 Ω	

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) This test cannot be performed on vehicles with E-gas. The kick-down switch -F8- in this case is integrated in the Throttle Position (TP) Sensor (-G79-, -G185-).

3) Solenoid for shift lock -N110- is also referred to as shift lock solenoid -N110-

01-290

Resistance measurement: switch multimeter to 20 K Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
18	14 + 42	Transmission VSS -G38- [2]	• Ignition switched off	min. 0.8 KΩ max. 1.2 KΩ	- Check wiring per wiring diagram.
	14 + 34 14 + 54 42 + 54 42 + 34			infinite Ω [1]	- Replace transmission VSS -G38-, ⇒ Fig. 10, Page 01-28 .
	15 + 34 15 + 54	Shielding for -G38-	• Ignition switched off	infinite Ω [1]	- Check wiring per wiring diagram.

[1] Switch VAG1526 to highest resistance (Ω) measuring range.

[2] Transmission Vehicle Speed Sensor (VSS) -G38- is also referred to as Sensor for Transmission Output RPM -G195-.

01-291

Resistance measurement: switch multimeter to 20 K Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
19 Only for hydraulic control -E17- 2)	16 + 44	Sensor for transmission RPM -G182-	• Ignition switched off min.	0.23 KΩ	- Check wiring per wiring diagram.
			max.	0.30 KΩ	
	44 + 34 44 + 54 16 + 54 16 + 34			infinite Ω 1)	- Replace sensor for transmission RPM -G182- , ⇒ Fig. 11, Page 01-29 .
	23 + 34 23 + 54	Shielding for -G182-	• Ignition switched off	infinite Ω 1)	- Check wiring per wiring diagram.

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) This test step can only be performed on transmission with hydraulic control E17. For information regarding the transmission installed:

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

01-292

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
20	21 + 22	Transmission Fluid (ATF) Temperature sensor -G93-	• Ignition switched off • ATF temperature		- Check wiring between 88-pin connector on TCM and 8-pin connector ⇒ page 01-302 . - Check wiring harness in transmission; replace if necessary. ATF temperature sensor -G93- is integrated in wiring harness in transmission.
			approx. 20 ° C	approx. 0.83 K Ω 2)	
			approx. 60 ° C	approx. 1.28 K Ω 2)	
			approx. 120 ° C	approx. 1.88 K Ω 2)	
	21 + 34 22 + 28 3)		• Ignition switched off	infinite Ω 1)	- Remove and install valve body ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

	21 + 54 22 + 54			infinite Ω 1)	

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) Permissible tolerance: ± 0.1 KΩ

3) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-293

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
21 A)	41 + 28 3) 41 + 34 41 + 55 41 + 26	Wiring to ECM (throttle signal)	• Ignition switched off • ECM disconnected	infinite Ω 1)	- Check wiring per wiring diagram.
	41 + xx 2)			less than 1.5 Ω	

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) Corresponding terminal assignment at Engine Control Module (ECM)

⇒ *Electrical wiring diagrams Troubleshooting & Component Locations*

A) Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM). Test is only for vehicles without CAN-Bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, enginer/transmission allocation, ratios, equipment*

3) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-294

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
22 A)	35 + 28 1) 35 + 34 35 + 55 35 + 26	Wiring to ECM (fuel consumption/load signal)	• Ignition switched off - ECM disconnected	more than 40 KΩ	- Check wiring per wiring diagram. - Disconnect connections to other components which also receive this signal and repeat measurement.
	35 + xx 2)			less than 1.5 Ω	- Check these components for short circuit if necessary (e.g. on-board computer).
			Change measuring range to 20 V	Measure Voltage	⇒ *Repair Manual, Electrical Equipment, Repair Group 01*
	35 + 34 35 + 28 1)		• Ignition switched on - ECM disconnected	Approx. 5 V	

1) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

2) Corresponding terminals at Engine Control Module (ECM).

⇒ *Electrical Wiring Diagrams & Component Locations*

A) Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM). Test is only for vehicles without CAN-Bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine and transmission allocation, ratios, equipment*

01-295

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
23 A)	40 + 28 3) 40 + 34	Wiring to ECM (engine RPM signal)	• Ignition switched off - ECM disconnected	15 - 80 KΩ	- Check wiring per wiring diagram. - Check on-board computer.
	40 + xx 2)			less than 1.5 Ω	⇒ *Repair Manual, Electrical Equipment, Repair Group 01*
24 A)	20 + 28 3) 20 + 34 20 + 55 20 + 26	Wiring to ECM (torque reduction)	• Ignition switched off - ECM disconnected	infinite Ω 1)	- Check wiring per wiring diagram.
	20 + xx 2)			less than 1.5 Ω	

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) Corresponding terminal assignment at Engine Control Module (ECM).

⇒ *Electrical Wiring Diagrams & Component Locations binder*

A) Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM). Test is only for vehicles without CAN-Bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, aggregate allocation, ratios, equipment*

3) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-296

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
25 A)	51 + 28 3) 51 + 34 51 + 55 51 + 26	Wiring to ECM (upshift/downshift signal)	• Ignition switched off - ECM disconnected	infinite Ω 1)	- Check wiring per wiring diagram.
	51 + xx 2)			less than 1.5 Ω	

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) Corresponding terminal assignment at Engine Control Module (ECM).

⇒ *Electrical Wiring Diagrams & Component Locations*

A) Signal is transmitted to Transmission Control Module (TCM) via the Engine Control Module (ECM). Test is only for vehicles without CAN-Bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, aggregate allocation, ratios, equipment*

3) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-297

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
26	13 + 34 13 + 6	Tiptronic switch -F189-	• Ignition switched on - Selector lever in D but not in tiptronic gate	approx. 10 V	- Check wiring according to wiring diagram.
			• Ignition switched on - Selector lever tiptronic gate	approx. 20 mV	- Check magnet on lateral gate cover [1)] - Repair shift mechanism, if necessary replace gate cover or circuit board with Tiptronic switch -F189 [1)] ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38* - Perform test step 29

[1)] The Tiptronic Switch -F189- receives its tiptronic gate recognition information or tiptronic up- and down-shift information via the large magnet which is mounted on the lateral gate cover of the gate cover. If the switch has become detached, the gate cover must be replaced.

01-298

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
27	46 + 54 46 + 55	Tiptronic Switch - F189-	• Ignition switched off - Selector lever in Tiptronic gate	less than 1.5V	With the Tiptronic Switch the driver can manually select the desired driving range 2)
			• Ignition switched on - Selector lever in Tiptronic gate and up-shift switch actuated	approx. battery voltage	- Check wiring according to wiring diagram. If installed also check wiring to Tiptronic steering wheel
	46 + 34 46 + 6		• Ignition switched on - Selector lever in D - Selector lever in Tiptronic gate - Selector lever in Tiptronic gate and downshift switch activated	approx. 12V	- Check magnet on lateral gate cover 1) - Repair shift mechanism, if necessary replace gate cover or circuit board with Tiptronic switch - F189- 1) ⇒ *Repair Manual, T5 Spd. Automatic Transmission 01V, Repair Group 37*
Continued ▼			• Ignition switched on - Selector lever in	approx. 15mV	- Perform test step 28

			Tiptronic gate and up-shift switch activated		

01-299

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG1598/20sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
27 cont'd	47 + 34 47 + 6	Tiptronic Switch -F189-	• Ignition switched on - Selector lever in D - Selector lever in Tiptronic gate - Selector lever in Tiptronic gate and up - shift switch activated	approx. 12V	With the Tiptronic Switch the driver can manually select the desired driving range 2) - Check wiring according to wiring diagram. If installed also check wiring to Tiptronic steering wheel
			• Ignition switched on - Selector lever in Tiptronic gate and down-shift switch activated	approx.15 mV	- Check magnet on lateral gate cover 1)
	46 + 54 47 + 55		• Ignition switched off - Selector lever in Tiptronic gate	less than 1.5V	- Repair shift mechanism, if necessary replace gate cover or circuit board with Tiptronic switch -F189- 1)
Continued ▼			• Ignition switched off - Selector lever in Tiptronic gate and	approx. battery voltage	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

			down-shift switch activated		- Perform test step 28

Notes and footnotes for test step 27 are on the next page.

01-300

1) The Tiptronic Switch -F189- receives its tiptronic gate recognition information or tiptronic up- and down-shift information via the large magnet which is mounted on the lateral gate cover of the gate cover. If the switch has become detached, the gate cover must be replaced.

2) If the selector lever in the Tiptronic gate is pressed toward the rear (-) or on vehicles with Tiptronic sport steering wheel one of the minus (-) buttons on steering wheel is pressed, a manual shift-down can be performed (down-shift). If the selector lever in the Tiptronic gate is pressed toward the front (+) or on vehicles with Tiptronic sport steering wheel one of the plus (+) buttons on steering wheel is pressed, a manual up-shift-can be performed (up-shift).

01-301

Resistance measurement					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
28 A)	85 + 28 3) 85 + 34 86 + 28 3) 86 + 34	Wiring connection of TCM to ECM (CAN-bus)	• Ignition switched off • ECM disconnected	infinite Ω 1)	- Check wiring per wiring diagram.
	85 + xx 2) 86 + xx 2)			less than 1.5 Ω	Further information on CAN-bus ⇒ page 01-263

1) Switch VAG1526 to highest resistance (Ω) measuring range.

2) Applicable terminal assignment at Engine Control Module (ECM).

⇒ *Repair Manual, Fuel Injection & Ignition, Repair Group 24*

A) Testing only for vehicles with a CAN-bus

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 00; Code letters, engine/transmission applications, ratios, equipment*

3) Pin 28 at the control module is vacant for vehicles with 10-pin connector of multi-function switch -F125-.

01-302

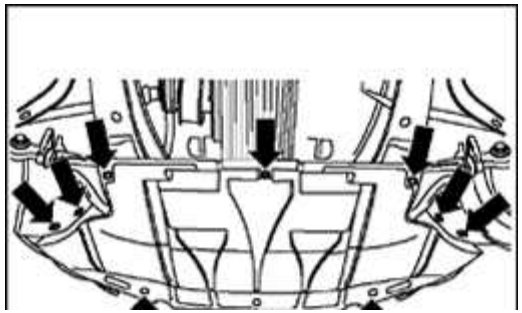
Wiring between transmission and 88-pin connector for Transmission Control Module (TCM) -J217-, testing

Perform if:

- Output Diagnostic Test Mode (DTM) or
- Electrical test indicates malfunctions in the transmission, the TCM -J217-, or in the corresponding wiring.

Test conditions

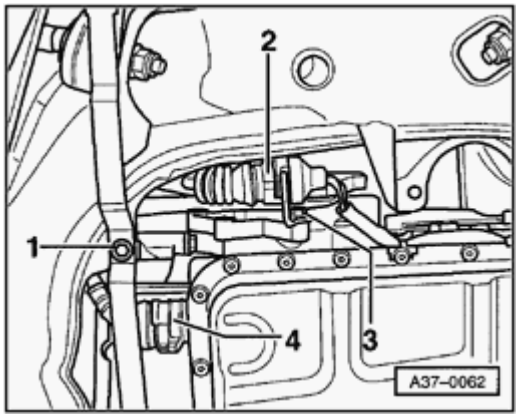
- Ignition switched off
- Connect VAG1598/20 adapter only to 88-pin connector of transmission wiring harness.
- Perform measurements with VAG1598/20 adapter on the outside of the vehicle



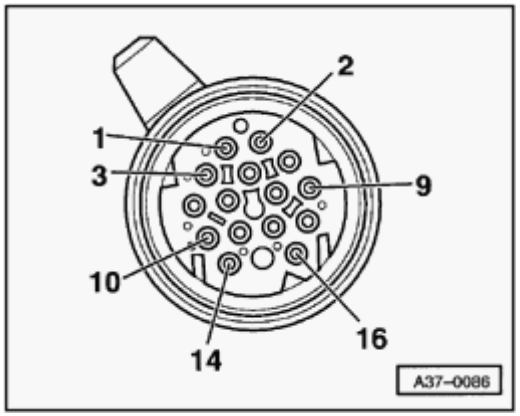
- Remove noise insulation panel.
- Remove bracket -1- for noise insulation panel.

01-303

Wiring to 16-pin connector on transmission, testing



- Turn 16-pin connector -4- on transmission to release bayonet catch.



- Use multimeter (Fluke 83 or equivalent) to test for continuity between terminals of 16-pin connector and sockets on VAG1598/20 adapter. Resistance specifications ⇒ table, page 01-304 .

01-304

Resistance specifications

Terminal on 16-pin connector	Socket on VAG1598/20 adapter	Specification	Corrective action
1	42	≤ 1.5 Ω	- Repair open circuit according to current wiring diagram. Check connectors for: - contact corrosion - ingress of water - leaks
2	5	≤ 1.5 Ω	
3	1	≤ 1.5 Ω	
4	32	≤ 1.5 Ω	
5	16	≤ 1.5 Ω	
6	44	≤ 1.5 Ω	
7	29	≤ 1.5 Ω	
8	30	≤ 1.5 Ω	
9	33	≤ 1.5 Ω	
10	14	≤ 1.5 Ω	
11	4	≤ 1.5 Ω	

12	52	≤ 1.5 Ω	
13	22	≤ 1.5 Ω	

01-305

Terminal on 16-pin connector	Socket on VAG1598/20 adapter	Specification	Corrective action
14	21	≤ 1.5 Ω	- Repair open circuit according to current wiring diagram. - Check connectors
15	Vacant		
16	53	≤ 1.5 Ω	

Notes:

- *If the readings in these tests match the specifications, check the wiring harness in the transmission.*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38; removing and installing valve body*

- *Only replace relevant solenoid valves if there are no faults found in the wiring harness in the transmission.*

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38, valve body removing and installing*

01-306

Multi-function Transmission Range (TR) switch, checking

Note:

- *Check the measuring value block for the TR-switch display group number 004 ⇒ page 01-203 before checking the TR-switch.*

- *Be sure that selector lever cable is properly adjusted.*

Two different multi-function switches were used in production:

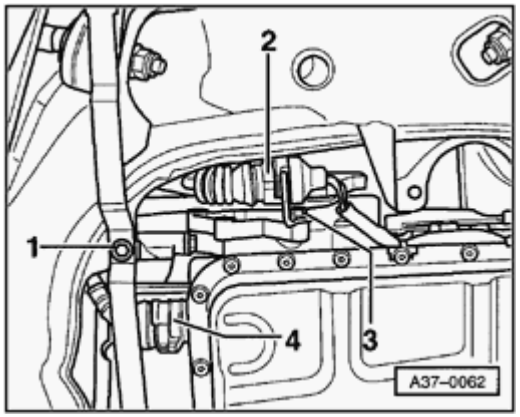
1. Multi-function switch with 8 - pin connector checking starting ⇒ page 01-308 .

2. Multi-function switch with 10 - pin connector checking starting ⇒ page 01-319 .

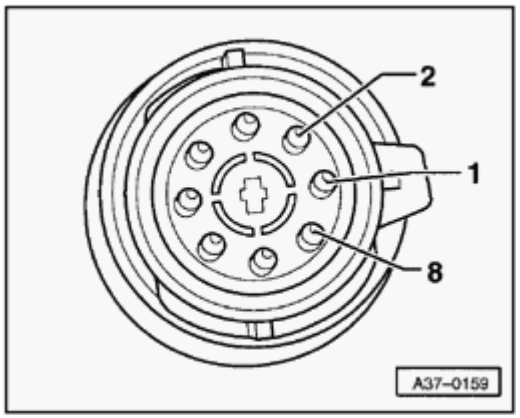
01-307

Multi-function Transmission Range (TR) switch -F125- (8-pin connector), testing

1. Function test



- Release spring catch securing 8-pin connector -2- to connector on wiring to multi-function TR switch.
- Unclip connector to multi-function TR switch from retainer or remove retainer together with connector from transmission to gain better access to the pins in the connector.



- Pin assignment for 8 - pin connector of Multi-function (TR) switch - F125-
- Use multi-meter VAG 1526A or Vehicle Diagnosis, Measuring and Information System VAS 5051.

01-308

Transmission with Multi-function Transmission Range (TR) switch -F125- with 8 - pin connector, checking

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**Connector pins at F 125**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
1	1 + 7 1 + 6	Multi-function TR switch - F126-	• Ignition switched off - Selector lever in P, R, N, D, 4, 3, and 2	infinitive Ω 1)	- Check connector on multi-function TR switch for corrosion, water ingress or loose connection
	1 + 2		• Ignition switched off - Selector lever in P, N, and D	smaller than 2 Ω	- If necessary adjust selector lever cable ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*
			- Selector lever in R, 4, 3, and 2	infinitive Ω 1)	
	1 + 3		• Ignition switched off - Selector lever in R, N, and 4	smaller than 2 Ω	
Continue ▼			• Ignition switched off	infinitive Ω 1)	- Replace multi-function TR switch ⇒ *Repair Manual, 5 Spd. Automatic*

			- Selector lever in P, D, 3, and 2		*Transmission 01V, Repair Group 38*

1) Switch VAG1526 to highest resistance (Ω) measuring range.

01-309

Transmission with Multi-function Transmission Range (TR) switch -F125- with 8 - pin connector, checking

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**Connector pins at F 125**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
Continued 1	1 + 4		• Ignition switched off - Selector lever in N, D, 4, and 2	infinitive Ω 1)	- Check connector on multi-function TR switch for corrosion, water ingress or loose connection
	1 + 5		- Selector lever in P, R, and 3	infinitive Ω 1)	- If necessary adjust selector lever cable
			• Ignition switched off - Selector lever in D, 4, and 3	smaller than 2 Ω	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*
Continue	1 + 8		- Selector lever in P, R, N, and 2	infinitive Ω 1)	- Replace multi-function TR switch
			• Ignition switched off - Selector lever in R	smaller than 2 Ω	
			- Selector lever in P,	infinitive Ω	

▼			N, D, 4, 3, and 2	1)	⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*

1) Switch VAG1526 to highest resistance (Ω) measuring range.

01-310

Transmission with Multi-function Transmission Range (TR) switch -F125- with 8 - pin connector, checking

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**Connector pins at F 125**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
Continued to 1	6 + 7	Part No. signal of Multi-function TR switch	• Ignition switched off - Selector lever in R, D, 4, 3, and 2	infinitive Ω 1)	- Replace multi-function TR switch ⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 38*
			• Ignition switched off - Selector lever in P, and N	less than 2 Ω	The Part No. signal for the Engine Control Module (ECM) is being checked

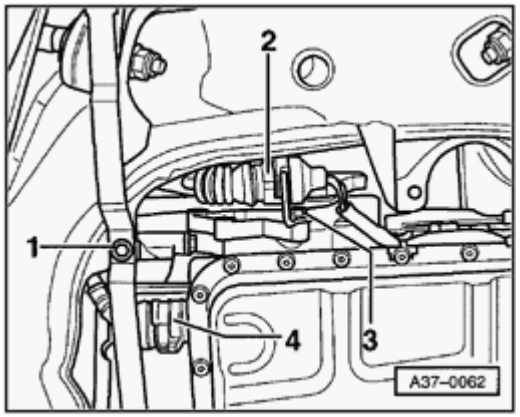
1) Switch VAG1526 to highest resistance (Ω) measuring range.

Note:

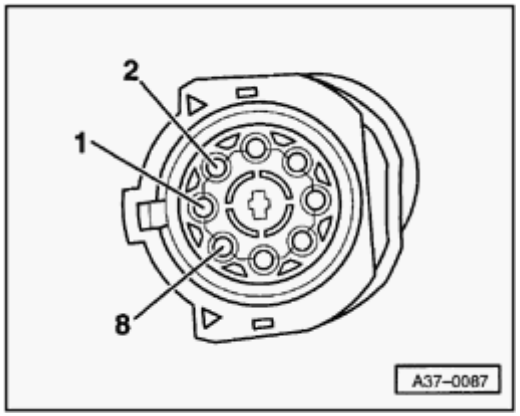
- *If function check was OK, check voltage supply to Multi-function TR switch -F125-* ⇒ *page 01-311*

01-311

2. Multi-function Transmission Range (TR) switch -F125- (8-pin connector), testing



- Release spring catch securing 8-pin connector -2- to connector on wiring to Multi-function TR switch.
- Check at connector with spring clips (cavities) to Transmission Control Module (TCM)



- Pin assignment for 8 - pin connector of multi-function (TR) switch - F125- (to TCM)
- Use multi-meter VAG 1526A or Vehicle Diagnosis, Measuring and Information System VAS 5051

Voltage measurement: switch multimeter to 20 V measuring range

Cavity in connector	Test condition	Specified value
1 + 6	Ignition switched on	Approx. battery voltage

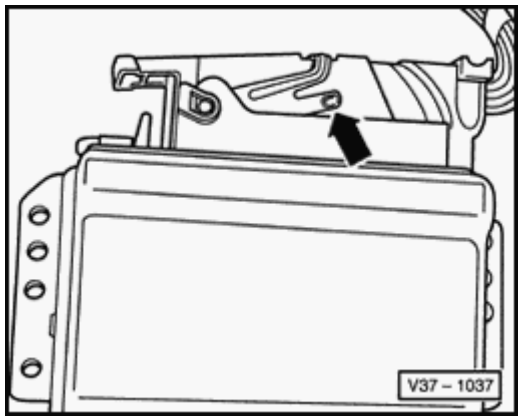
01-312

- If the specified value is not read, check fuses and wiring connectors according to wiring diagram and make necessary repairs.

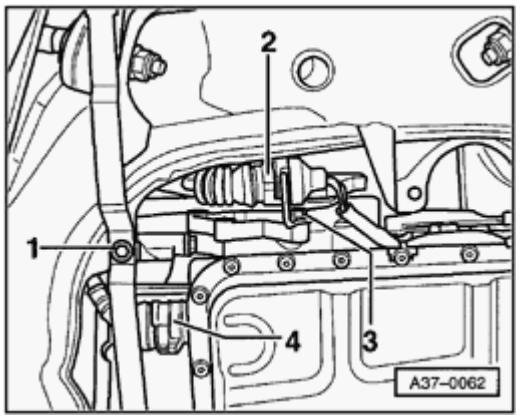
Note:

If the check results and the voltage supply to the Multi-function TR switch were OK, check wiring connections from Transmission Control Module (TCM) -J217- to Multi-function Transmission Range (TR) switch ⇒ *page 01-316*

3. Wiring from Transmission Control Module (TCM) -J217- to Multi-function Transmission Range (TR) switch -F125- (8-pin connector), checking



- Switch off ignition.
- Disconnect connector from TCM -J217-, located in front of right seat under the cover in the footwell ⇒ page 01-20 .
- Connect test box VAG 1598/20 to harness connector.



- Connect both 8-pin connectors -2- to multi-function switch -F125- as shown in the illustration.
- Use multi-meter VAG 1526A or Vehicle Diagnosis, Measuring and Information System VAS 5051

01-314

Transmission with Multi-function Transmission Range (TR) switch -F125- with 8 - pin connector, checking

Voltage measurement: switch multimeter to 20 V measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
1	36 + 34 36 + 6	Multi-function Transmission Range (TR) switch -F125-	• Ignition switched on - Selector lever in P, N, and D	Approx. 12 V	- Check connector at multi-function switch for corrosion - Check wiring per wiring diagram
			- Selector lever in R, 4, 3, and 2	Less than 1 V	- Check fuses - Check voltage supply to -F125- ⇒ page 01-311 .
	8 + 34 8 + 6		• Ignition switched on - Selector lever in R, N, and 4	Approx. 12 V	- Check wiring from 88-pin control module to 8-pin connector ⇒ page 01-319 .
			- Selector lever in P, D, 3, and 2	Less than 1 V	
	37 + 34 37 + 6		- Selector lever in N, D, 4, and 2	Approx. 12 V	

			- Selector lever in P, R, and 3	Less than 1 V	
	9 + 34 9 + 6		- Selector lever in D, 4, and 3	Approx. 12 V	
			- Selector lever in P, R, N, and 2	Less than 1 V	

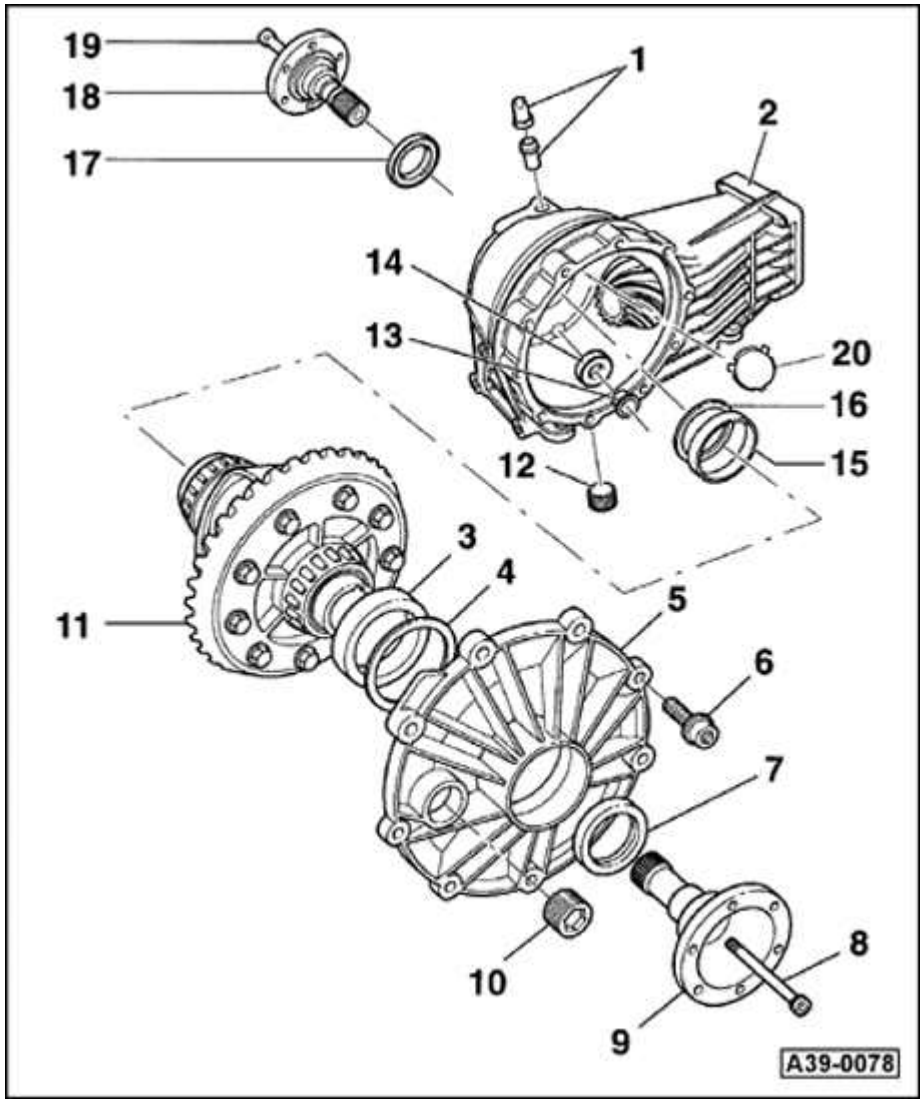
01-315

Transmission with Multi-function Transmission Range (TR) switch -F125- with 8 - pin connector, checking

Resistance measurement: switch multimeter to 2 M Ω measuring range					
Test step	**VAG 1598/20 sockets**	**Test of**	• Test conditions - Additional steps	**Specified value**	**Corrective action**
2	36 + 8	Multi-function Transmission Range (TR) switch -F125	• Ignition switched off - Selector lever in N	less than 26 Ω	- Check connector at multi-function switch for corrosion
			- Selector lever in P, R, D, 4, 3, and 2	infinitive Ω [1)]	- Check wiring from 88-pin control module to 8-pin connector ⇒ page 01-319 .
	37 + 9		• Ignition switched off - Selector lever in D and 4	less than 26 Ω	- Perform test steps 6 and 27.
			- Fuse 31 removed [2)] - Selector lever in P, R, N, 3 and 2	infinitive Ω [1)]	
	37 + 36		• Ignition switched off	less than 26 Ω	

			- Selector lever in N, and D		

39-128



Differential, removing and installing

Notes:

- *General repair notes ⇒ page 00-27 .*
- *Secure final drive to assembly stand ⇒ page 39-123 .*
- *Adjustments are required when replacing components marked with 1) ⇒ Adjustment overview ⇒ page 39-170 .*

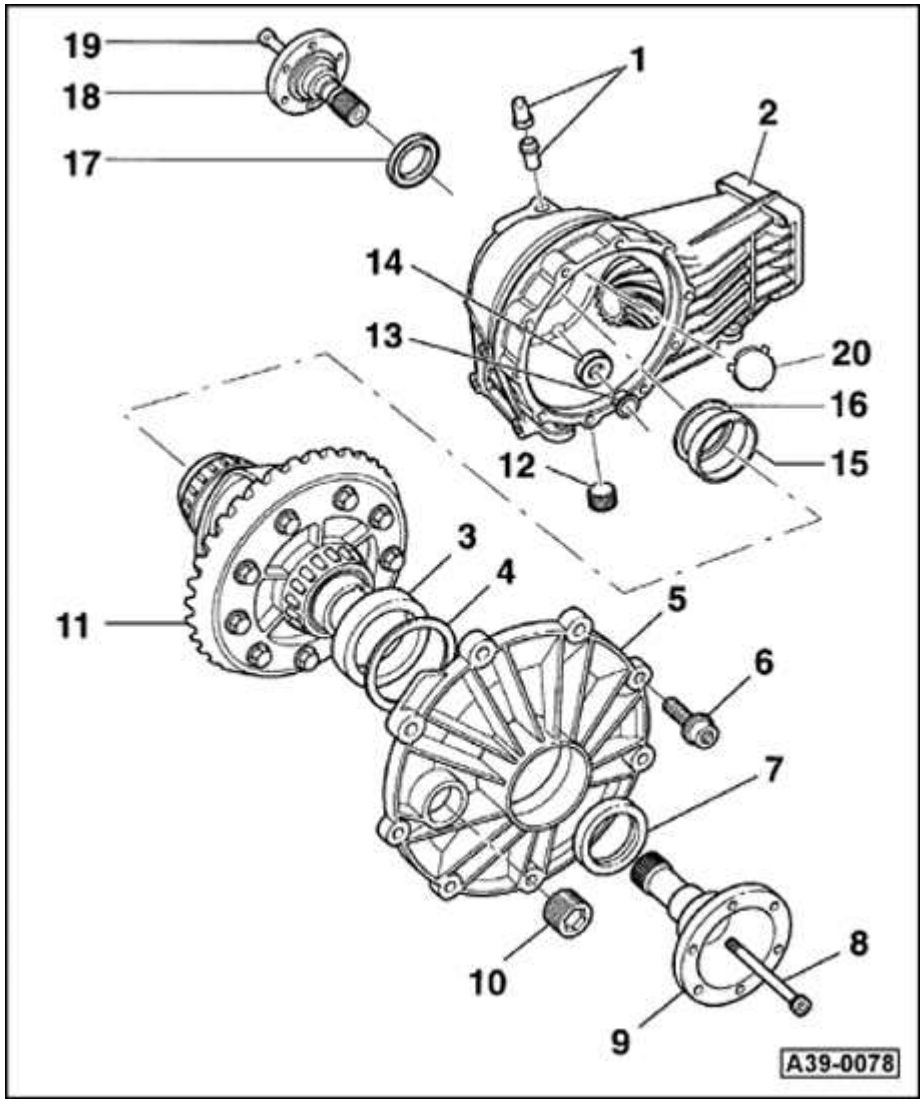
1 - Breather sleeve

- With rubber valve
- Installed position Item

2 - Final drive housing 1)

- With drive pinion
- Drive pinion, removing and installing ⇒ page 39-152

39-129



3 - Large tapered roller bearing outer race [1)]

- Driving out ⇒ Fig. 7 , ⇒ page 39-147
- Pressing in ⇒ Fig. 8 , ⇒ page 39-148

4 - Adjustment shim "S1"

- Note thickness
- Adjustment overview ⇒ page 39-170

5 - Cover for final drive [1)]

- With O-ring
- Replacing O-ring
- Insert O-ring with oil

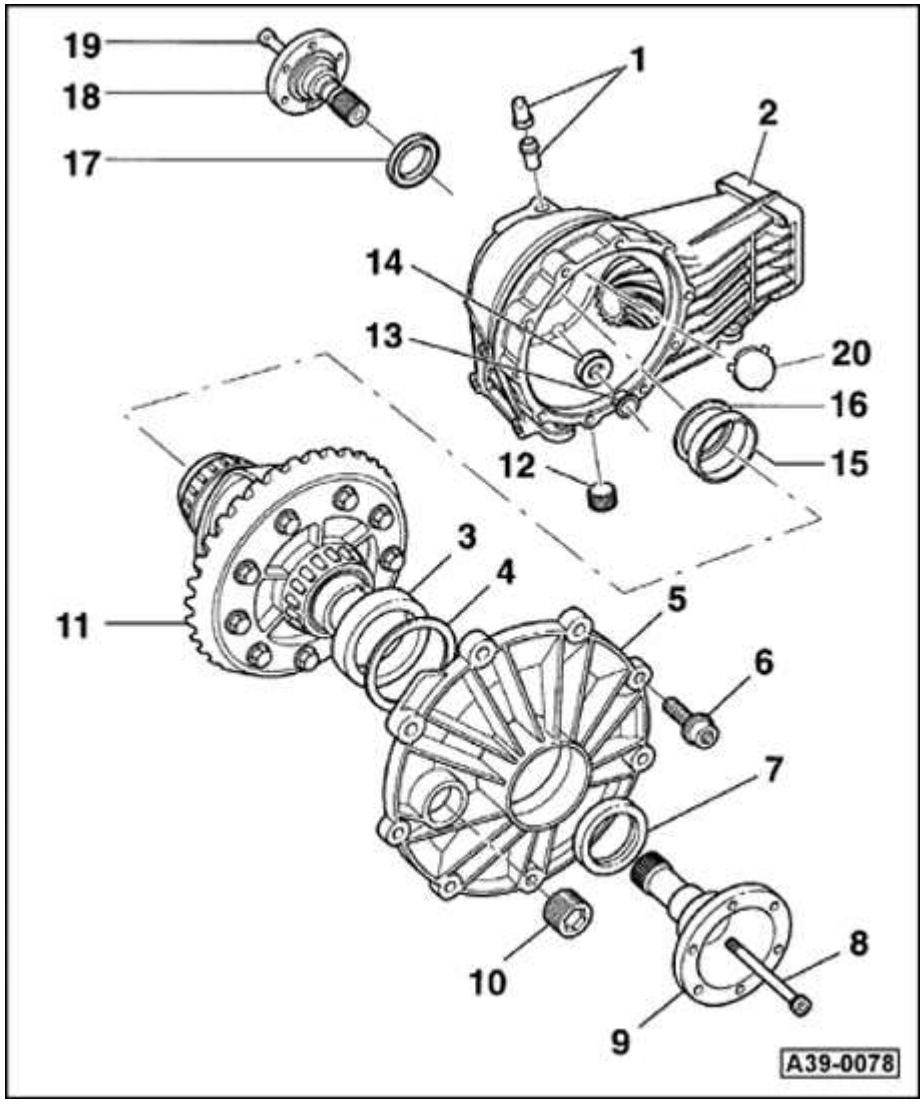
6 - TORX bolt - 25 Nm

7 - Right gasket

- Always replace ⇒ page 39-113

8 - Socket head bolt - 25 Nm

39-130



9 - Right drive flange

- Removing and installing ⇒ Fig. 1

10 - Oil filler plug - 35 Nm

11 - Differential with ring gear 1)

- Disassembling and assembling ⇒ page 39-136

12 - Oil drain plug - 35 Nm

13 - Socket

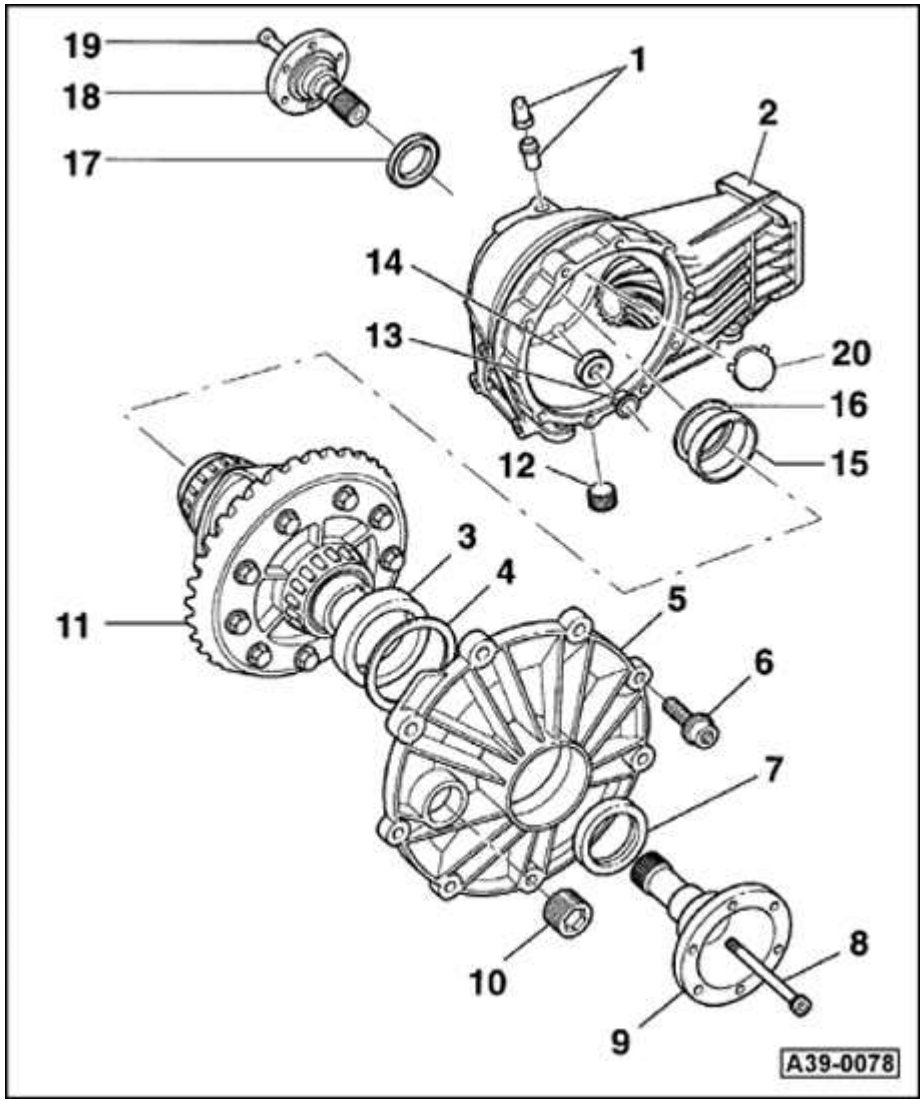
- Holds the magnet in position
- Press in until stop

14 - Magnet

15 - Small tapered roller bearing outer race 1)

- Driving out ⇒ Fig. 1 , ⇒ page 39-144
- Pressing in ⇒ Fig. 2 , ⇒ page 39-144

39-131



16 - Shim "S2"

- Note thickness
- List of adjustments ⇒ page 39-170

17 - Left gasket

- Always replace ⇒ page 39-113

18 - Left drive flange

- Removing and installing ⇒ Fig. 1

19 - Socket head bolt - 25 Nm

20 - Cover

- Installing ⇒ Fig. 2

39-132

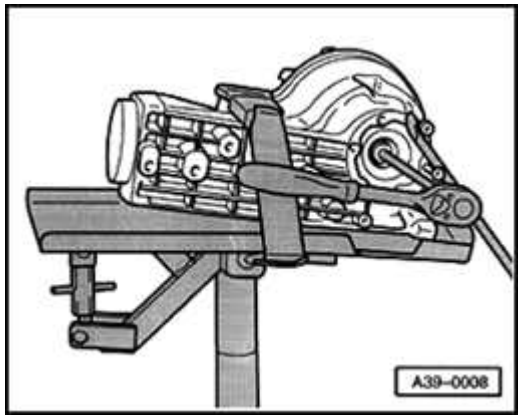


Fig. 1 Removing and installing drive flange

- To loosen securing bolt, thread 2 bolts into drive flange and counter hold using tire iron.
- Remove drive flange at installed bolts.

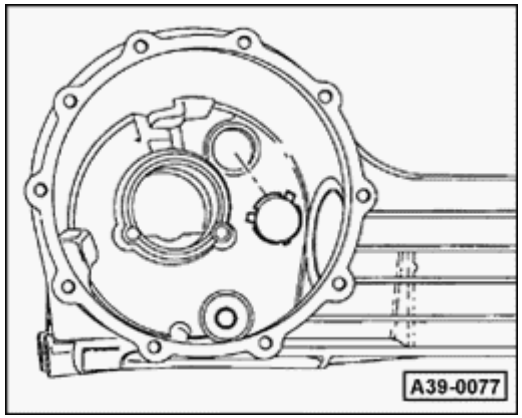


Fig. 2 Press in cover up to stop

39-133

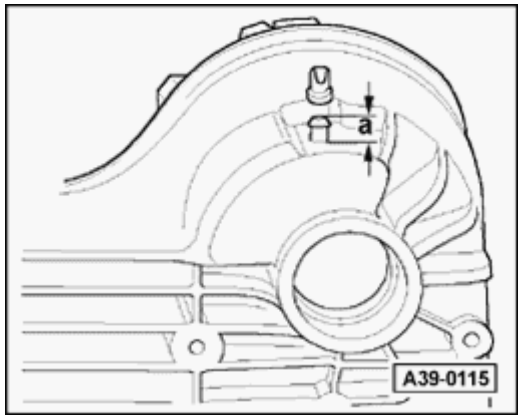


Fig. 3 Installed position of breather sleeve

The breather sleeve must protrude 13 mm (measurement -a-) out of housing after pressing in.

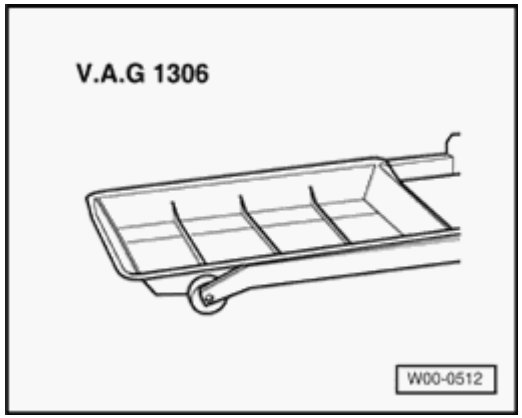
The slot in the rubber valve is parallel to direction of travel.

39-134

Differential, removing and installing

- Rear final drive removed

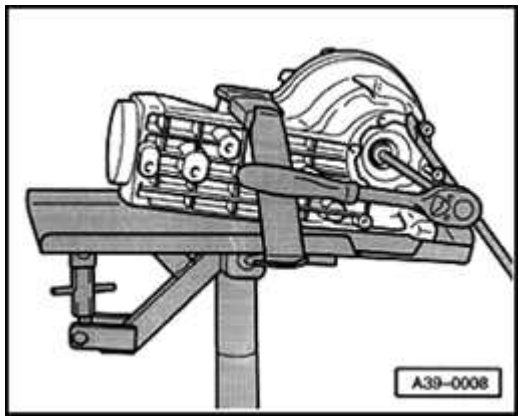
Special tools and equipment



- VAG1306 drip tray

Removing

- Secure complete rear final drive to assembly stand ⇒ page 39-123 .
- Place VAG1306 drip tray underneath and drain gear oil.



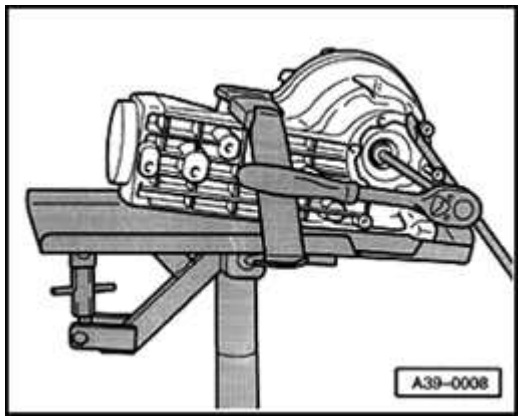
- Remove left and right drive flanges.
- To loosen securing bolt, thread 2 bolts into drive flange and counter hold using tire iron.
- Mark left and right drive flanges.
- Remove drive flange at installed bolts.
- Remove mounting bolts for final drive cover.
- Remove final drive cover from axle housing and remove differential.

39-135

Installing

Installation is reverse of removal, noting the following:

- Install differential.
- Replace O-ring for final drive cover and oil for installation.
- Install final drive cover onto final drive housing and tighten in diagonal pattern to 25 Nm.
- Replace drive flange seals ⇒ page 39-113 .
- Fill gap between sealing lip and dust lip with multi-purpose grease.



- Install drive flanges and tighten to 25 Nm.
- Top-up and check gear oil in rear final drive ⇒ page 39-94 .

30-1

Clutch mechanism, servicing

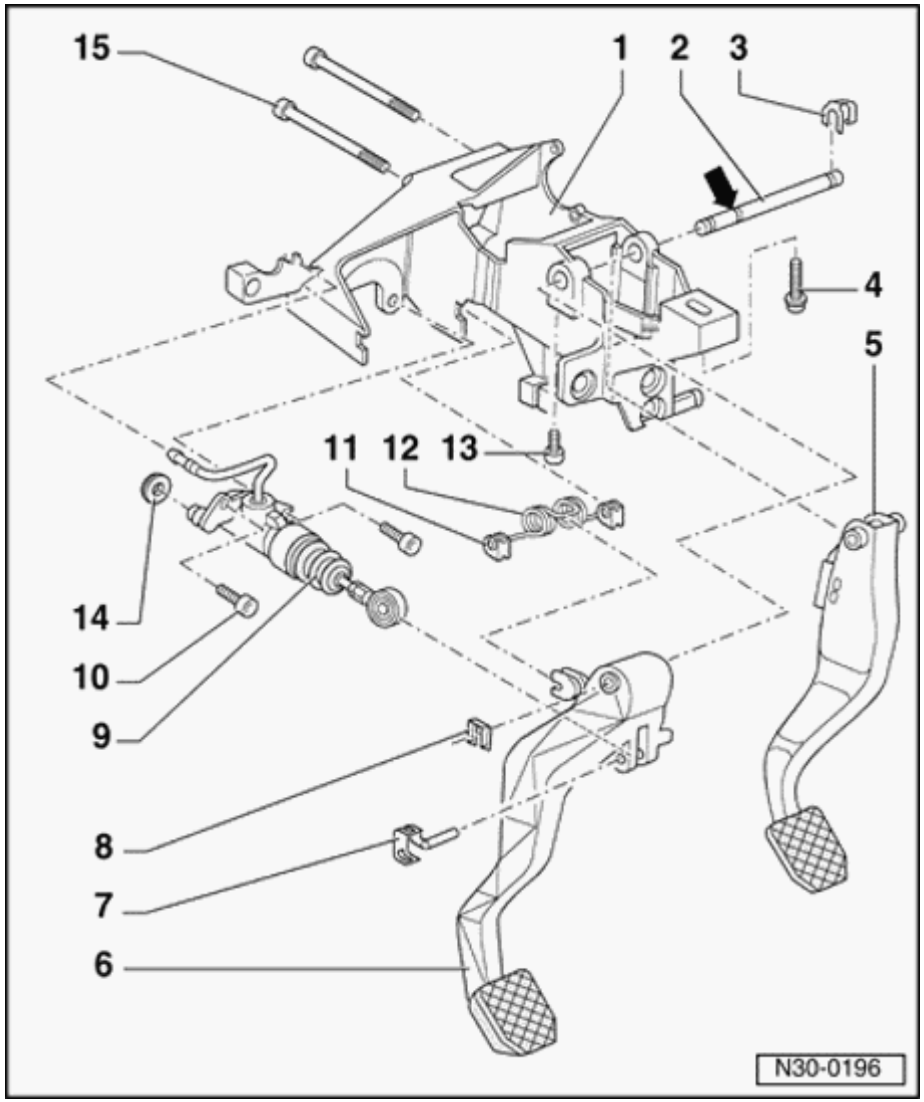
Notes:

- *Determine the correct coding for the anti-theft radio (if equipped).*
- *Switch the ignition off and disconnect battery Ground (GND) strap.*
- *Lubricate all bearings and contact surfaces with G 052 142 A 2 polycarbamide grease.*
- *Before working on the pedal cluster, remove the driver's side storage compartment*

⇒ *Repair Manual, Body Interior, Repair Group 68.*

- *Make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does happen, clean the affected areas thoroughly.*
- *When working in the floor area, cover the carpet with a cloth to protect against any leaking brake fluid.*

30-2



Clutch pedal and clutch control overview

1 - Mounting bracket

- Removing and installing ⇒ Repair Manual, Brake System, Repair Group 46

2 - Pivot pin

- For clutch and brake pedals
- Installation position: groove (arrow) facing clutch pedal

3 - Locking clip

4 - Socket-head bolt

- 25 Nm (18 ft lb)

5 - Brake pedal

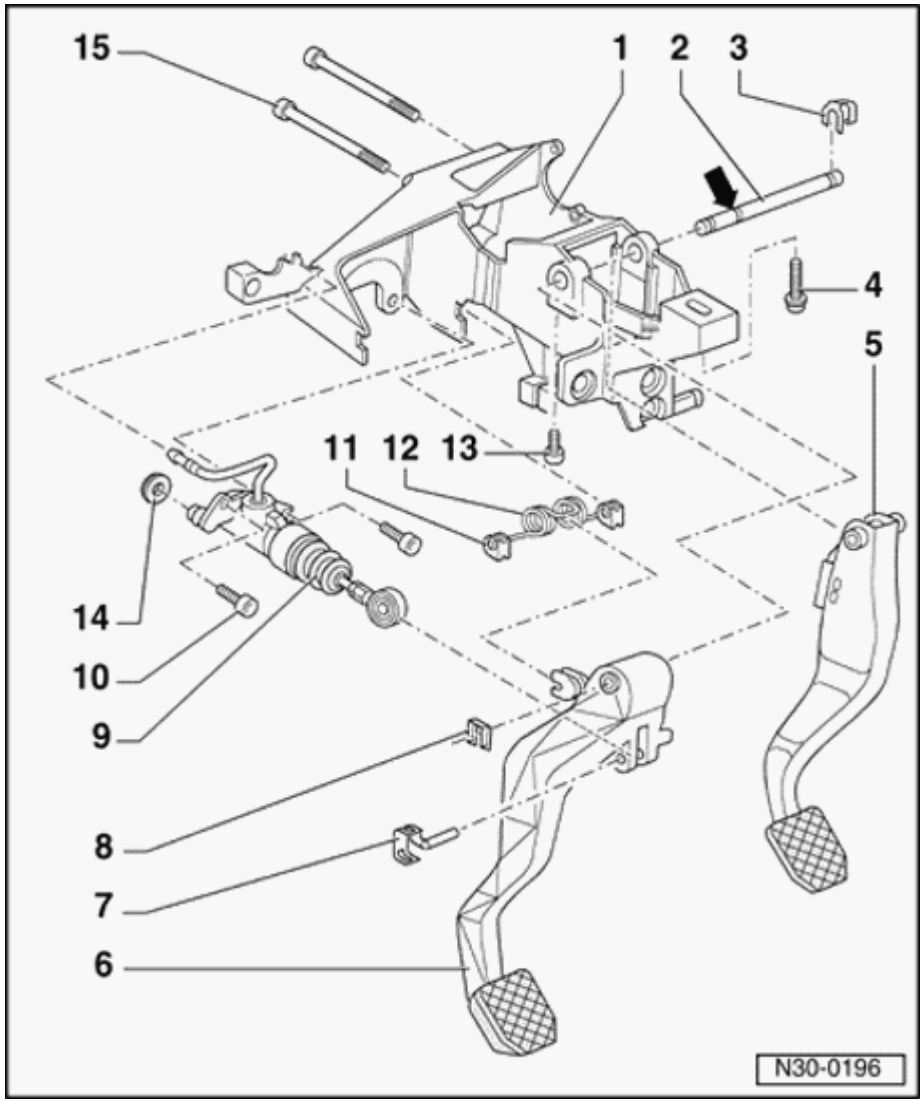
6 - Clutch pedal

- Removing and installing ⇒ Page 30-4

7 - Pin and locking plate

- Clip onto clutch pedal

8 - Locking clip



9 - Clutch master cylinder

- Removing and installing ⇒ Page 30-11
- Do not operate after clutch pedal has been removed

10 - Socket-head bolt

- 20 Nm (15 ft lb)

11 - Mount

- Insert in mounting bracket with over-center spring

12 - Over-center spring

- Application ⇒ parts catalog
- Remove and install together with clutch pedal ⇒ Page 30-4

13 - Socket-head bolt

- 5 Nm (44 in. lb)
- Secures pivot pin for clutch and brake pedal

14 - Seal

15 - Torx® bolt

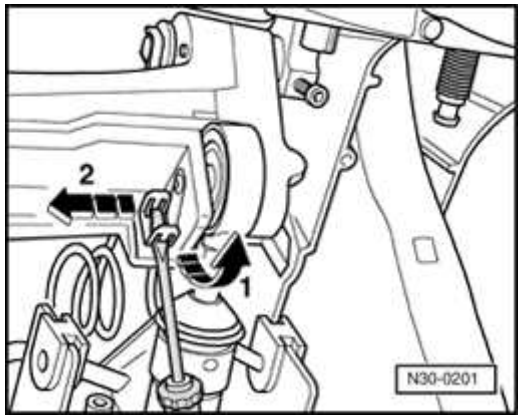
- 25 Nm (18 ft lb)
- Also secures brake master cylinder to brake servo

Clutch pedal and over-center spring, removing and installing

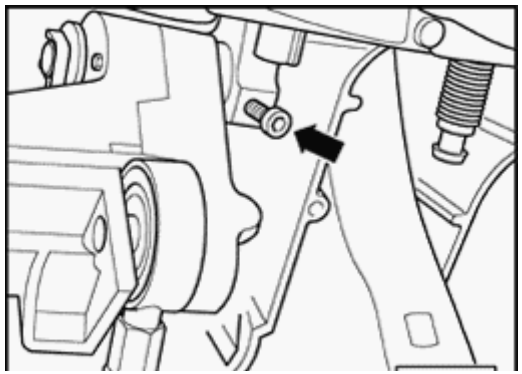
Removing

- Remove driver's side storage compartment ⇒ Repair Manual, Body Interior, Repair Group 68.

- If installed, remove switch above clutch pedal.



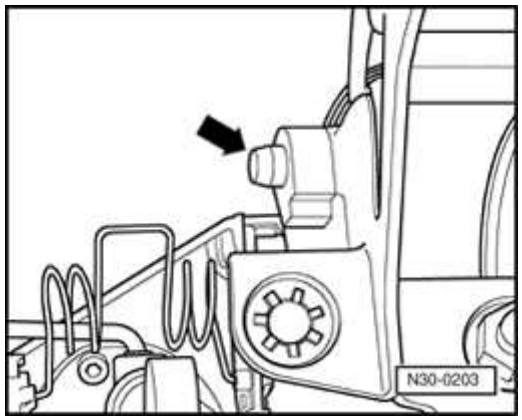
- Unclip pin and locking plate using screwdriver (arrow -1-), remove pin and locking plate (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Press locking clip for clutch pedal off pivot pin using screwdriver.



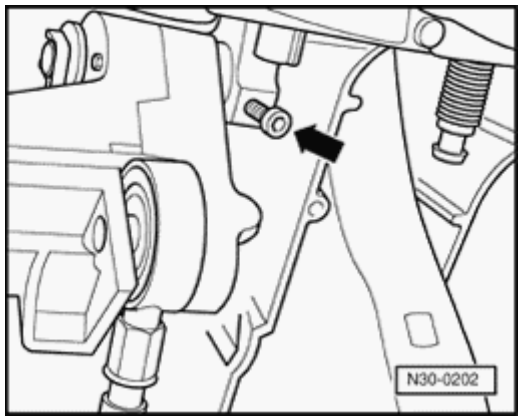
- Remove bolt (arrow).
- Press clutch and brake pedal pivot pin out toward right, until clutch pedal can be removed.
- If necessary, press locking clip for brake pedal off pivot pin using screwdriver.
- Remove clutch pedal and over-center spring.

Installing

Installation is the reverse of removal, note the following:

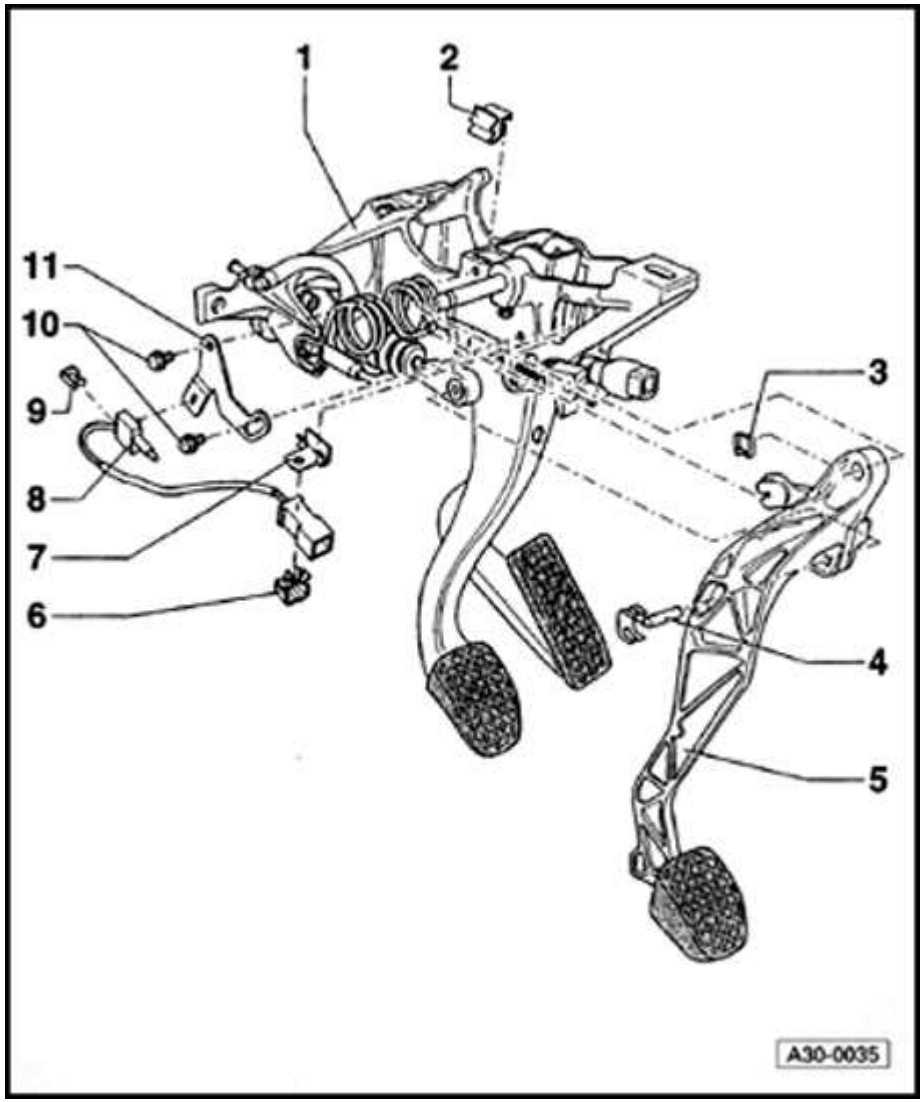


- Align pivot pin so that it protrudes out of mounting bracket on clutch pedal side (arrow).
- Hook clutch pedal into over-center spring, then install onto pivot pin.
- Connect clutch pedal to master cylinder. Clip locking pin onto clutch pedal.



- Do not tighten bolt (arrow) until both securing clips have been installed on pivot pin.

30-6



Clutch Pedal Position (CPP) switch -F194-, removing and installing

Note:

The Clutch Pedal Position Switch (CCP) -F194- allows the engine to be started only with the clutch pedal depressed. Introduction 05.97 ➢.

1 - Mounting bracket

- Before removing, remove steering column from steering gear ⇒ Repair Manual, Suspension, Wheels, Steering, Repair Group 48

2 - Cable bracket

3 - Locking clip

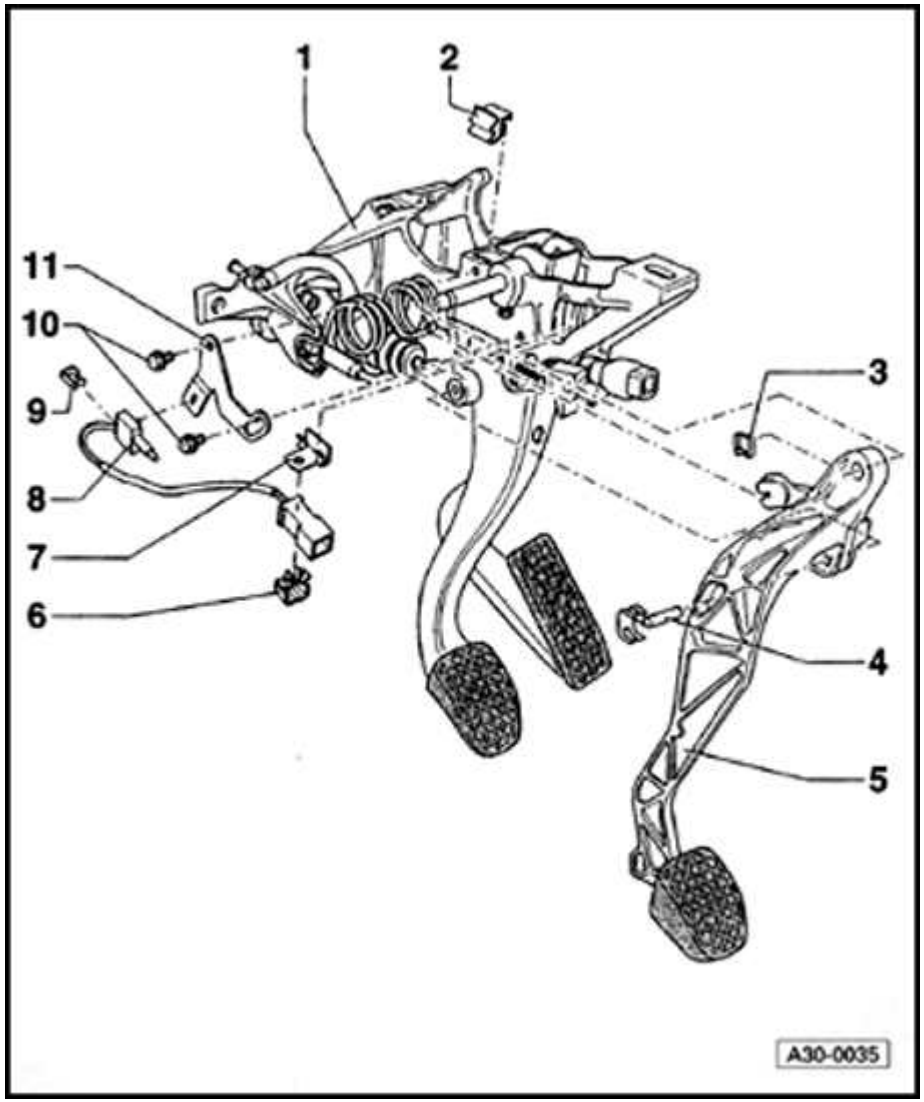
4 - 5Pin and locking plate

- Latched in clutch pedal

6 - Clutch pedal

- Removing and installing ⇒ Page 30-4

7 - Clip



8 - Bracket for harness connector

9 - Clutch Pedal Position (CPP) switch -F194-

- Adjusting ⇒ Page 30-8

10 - Clip

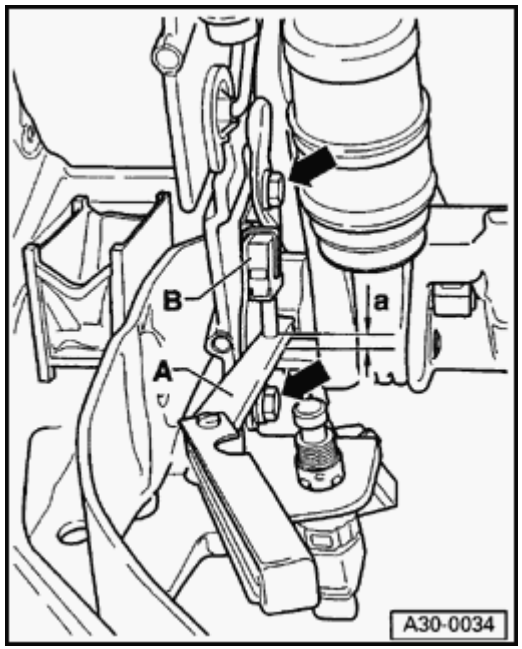
11 - Screw and washer assembly

- 8 Nm (71 in. lb)

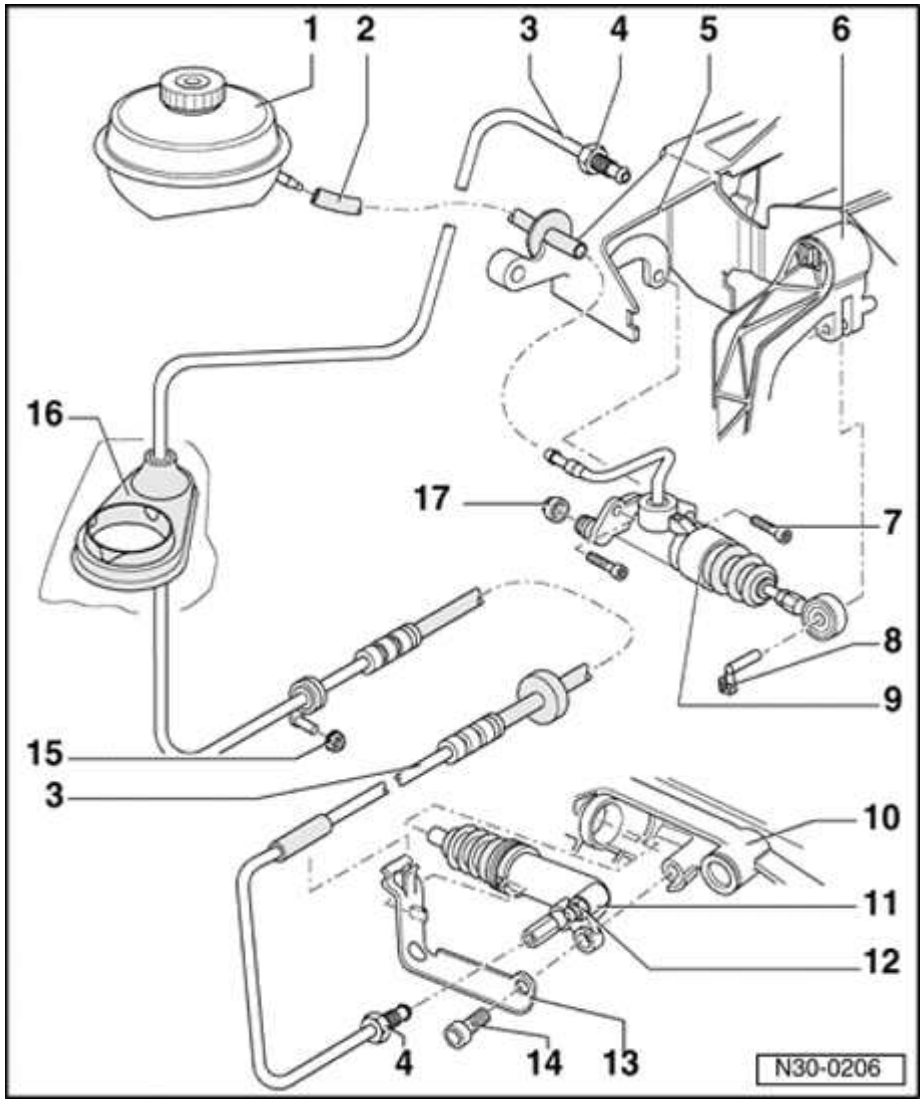
12 - Mounting plate

30-8

Clutch Pedal Position (CPP) switch - F194-, adjusting



- Loosen two bolts slightly (arrows).
- Have second technician fully depress clutch pedal up to stop.
- Place feeler gauge -A- with specific dimension -a- 3.2 mm +/- 0.2 mm (0.126 in. +/- 0.008 in.) between operating surface of clutch pedal and switch cam.
- Move switch -B- toward gauge -A- until stop, and tighten two mounting bolts (arrows) to 8 Nm (71 in. lb).



Clutch hydraulic system, servicing

1 - Brake fluid reservoir

2 - Supply hose

- For clutch master cylinder

3 - Hose/line assembly

- With threaded connections on clutch master cylinder and clutch slave cylinder

4 - Line fitting nut

- 15 Nm (11 ft lb)

5 - Mounting bracket

6 - Clutch pedal

- Removing and installing ⇒ Page 30-4

7 - Socket-head bolt

- 20 Nm (15 ft lb)

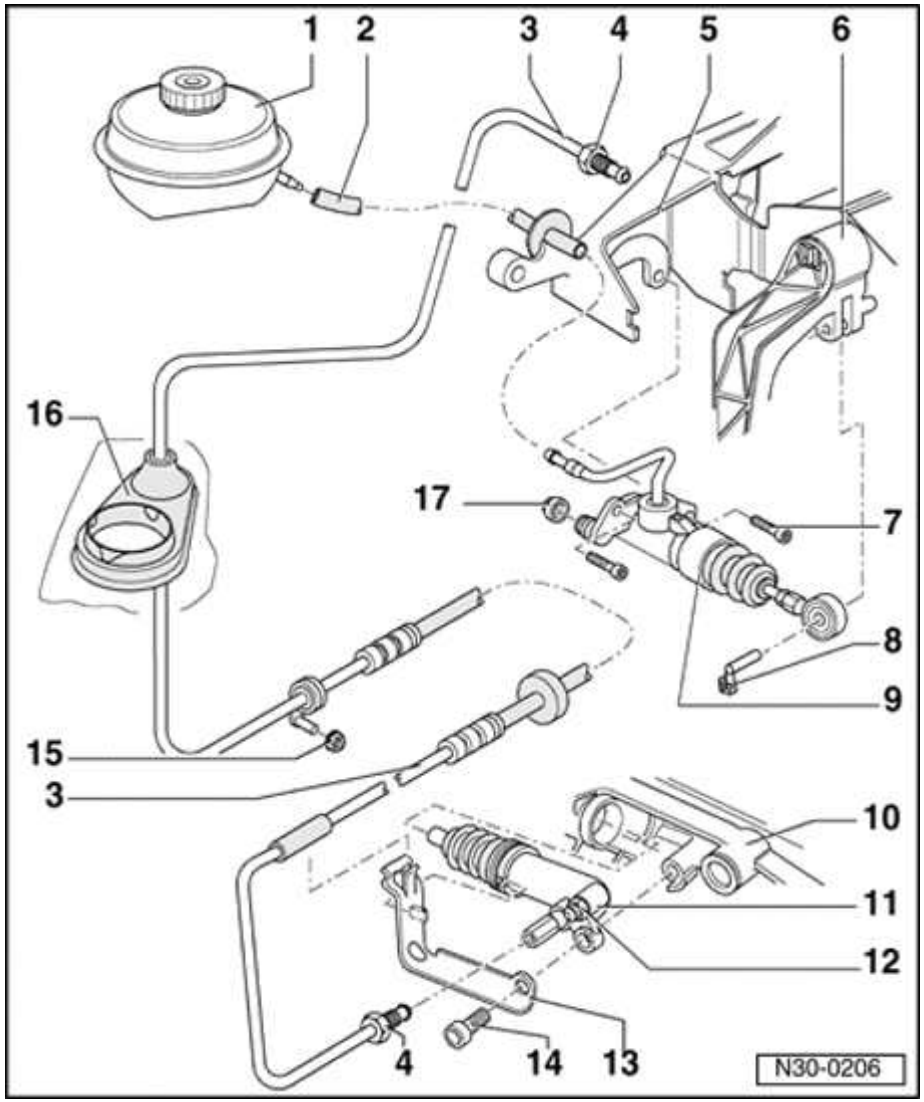
8 - Pin and locking plate

9 - Clutch master cylinder

- Removing and installing ⇒ Page 30-11

10 - Transmission

30-10



11 - Clutch slave cylinder

- Installing ⇒ Page 30-20
- After working on hydraulic clutch mechanism, bleed clutch slave cylinder ⇒ Page 30-15
- Do not press clutch pedal after clutch slave cylinder has been removed

12 - Bleeder valve

- 4.5 Nm (40 in. lb)
- Observe all CAUTIONS, WARNINGS, Notes and procedures when bleeding ⇒ Page 30-15

13 - Bracket

- Mounted to transmission

14 - Bolt

- 25 Nm (18 ft lb)

15 - Nut

- 2 Nm (18 in. lb)

16 - Seal

17 - Seal

- Must not be removed

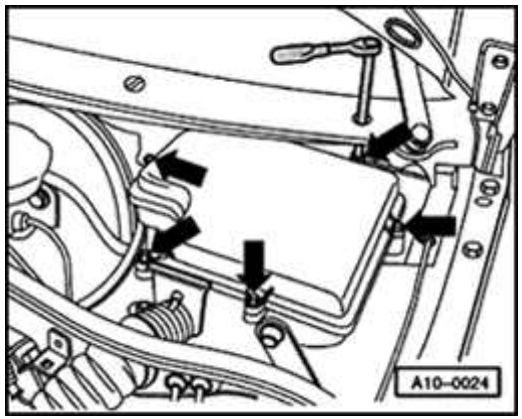
Clutch master cylinder, removing and installing

Special tools and equipment

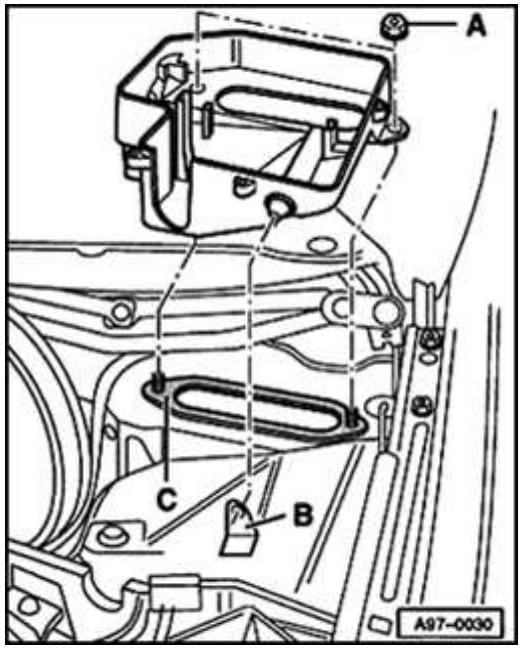
3094 hose clamp

Removing

To remove E-box from plenum chamber:



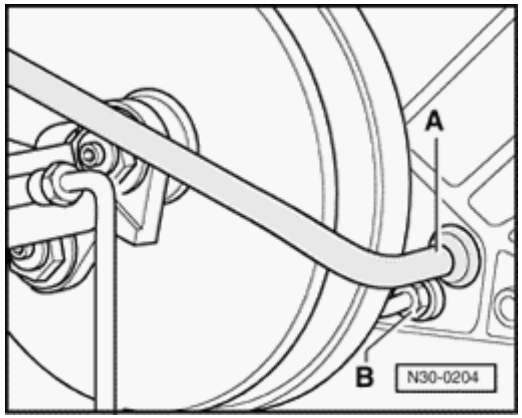
- Remove bolts (arrows) and remove cover.
- Remove Engine Control Module (ECM); if necessary, remove 8-pin relay support ⇒ Repair Manual, Electrical Equipment, Repair Group 97.
- Disconnect harness connectors at connector station.
- Remove engine wiring harness together with rubber grommet from opening in E-box.



- Remove both nuts -A-.
- Lift E-box out at rear of threaded bolt and remove from mounting point -B-.

Notes:

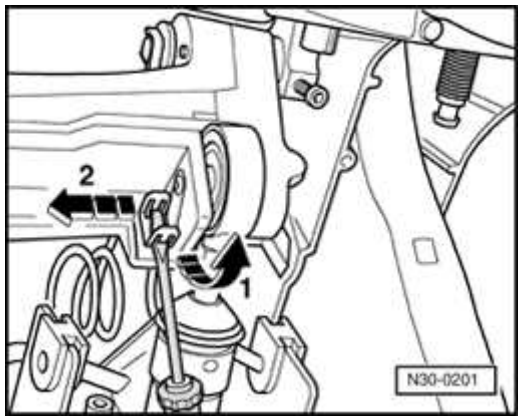
- *When carrying out the following steps, make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does occur, clean thoroughly.*
- *When working in the floor area cover the carpet with a cloth to protect against any leaking brake fluid.*



- Clamp supply hose -A- from brake fluid reservoir using 3094 hose clamp. Pull hose off clutch master cylinder and plug hose.
- Disconnect line -B- from clutch master cylinder and seal.

- Remove driver's side storage compartment ⇒ Repair Manual, Body Interior, Repair Group 68.

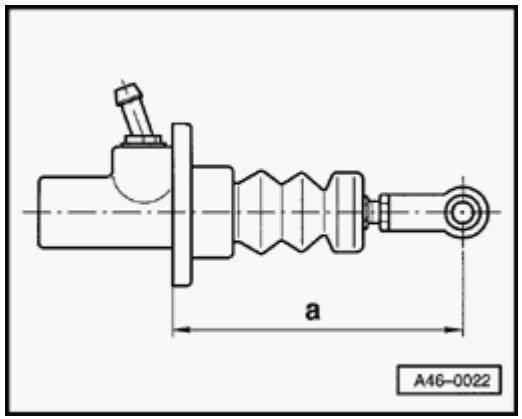
- Remove clutch pedal position switch if installed ⇒ Page 30-6 .



- Unclip pin using screwdriver (arrow -1-), pull out pin (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Unbolt clutch master cylinder from passenger compartment.

Installing

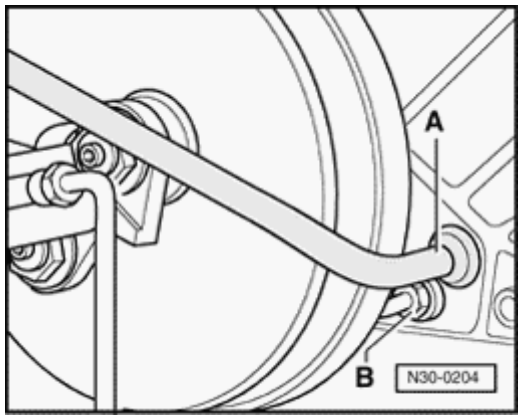
Installation is the reverse of removal, note the following:



- When replacing clutch master cylinder, check dimension -a- on ball head and adjust if necessary.

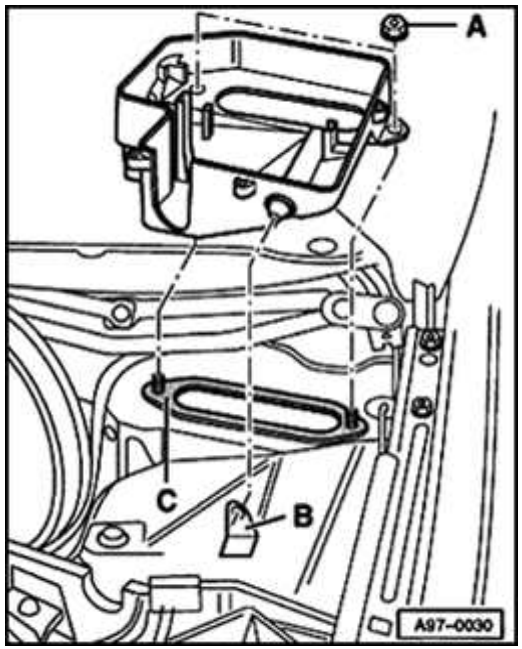
  Dimension -a- = 165 ± 0.5 mm (6.496 ± 0.020 in.)

- Connect clutch master cylinder to clutch pedal.
  Secure pin and locking plate on clutch pedal.



- Tighten line fitting -B- to clutch master cylinder to 15 Nm (11 ft lb).
- Slide hose -A- onto brake fluid reservoir up to stop.
- Bleed hydraulic clutch system after installing clutch master cylinder ⇒ Page 30-15 .

To install E-box in plenum chamber:



- Always replace seal -C-.
- Make sure seal is positioned properly, and does not cover opening or stepped metal edge.
- Install E-box into mounting point -B-.
- Tighten nuts -A- to 4 Nm (35 in. lb).
- Install cap and hand tighten in diagonal sequence to 4 Nm (35 in. lb) ⇒ imprint on E-box cover.

Clutch system, bleeding

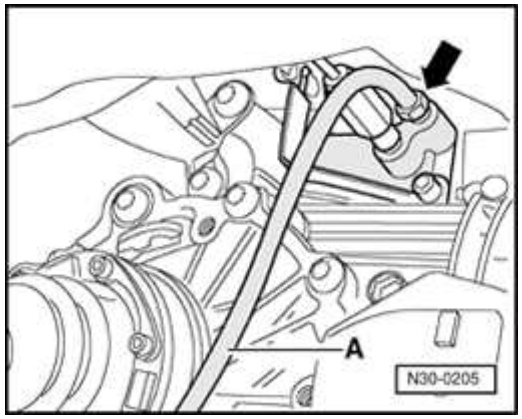
Special tools and equipment

- VAG1238B brake filling and bleeding appliance or
- VAG1869 brake filling and bleeding appliance

Notes:

- *When carrying out the following steps, make sure that no brake fluid escapes onto the transmission.*
- *The clutch system must be bled after carrying out work on the hydraulic clutch mechanism.*
- *Top off brake fluid reservoir to "MAX." mark with brake fluid before bleeding clutch system.*

- Pull clutch pedal back to rest position.
- Connect VAG1238B brake filling and bleeding appliance or VAG1869 but do not switch on.



- Connect bleeder hose -A- to clutch slave cylinder (arrow) and open bleeder valve.
- Connect bleeder hose with pressure hose to collector bottle.
- Switch on bleeding appliance and let approx. 100 cm3 (approx. 3.4 fl. oz) brake fluid flow into suitable collection reservoir.

  Work pressure: 2.5 bar (36 psi)

Note:

While bleeding, make sure bleeder hose remains correctly routed.

- Close bleeder valve.

  Tightening torque: 4.5 Nm (40 in. lb).
- Depress clutch pedal several times after completion of bleeding process.
- Bleed system again if necessary.

30-1

Clutch mechanism, servicing

CAUTION!

Before disconnecting the battery:

- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Part numbers are listed here for reference only. Always check with your Parts department for the latest information.***

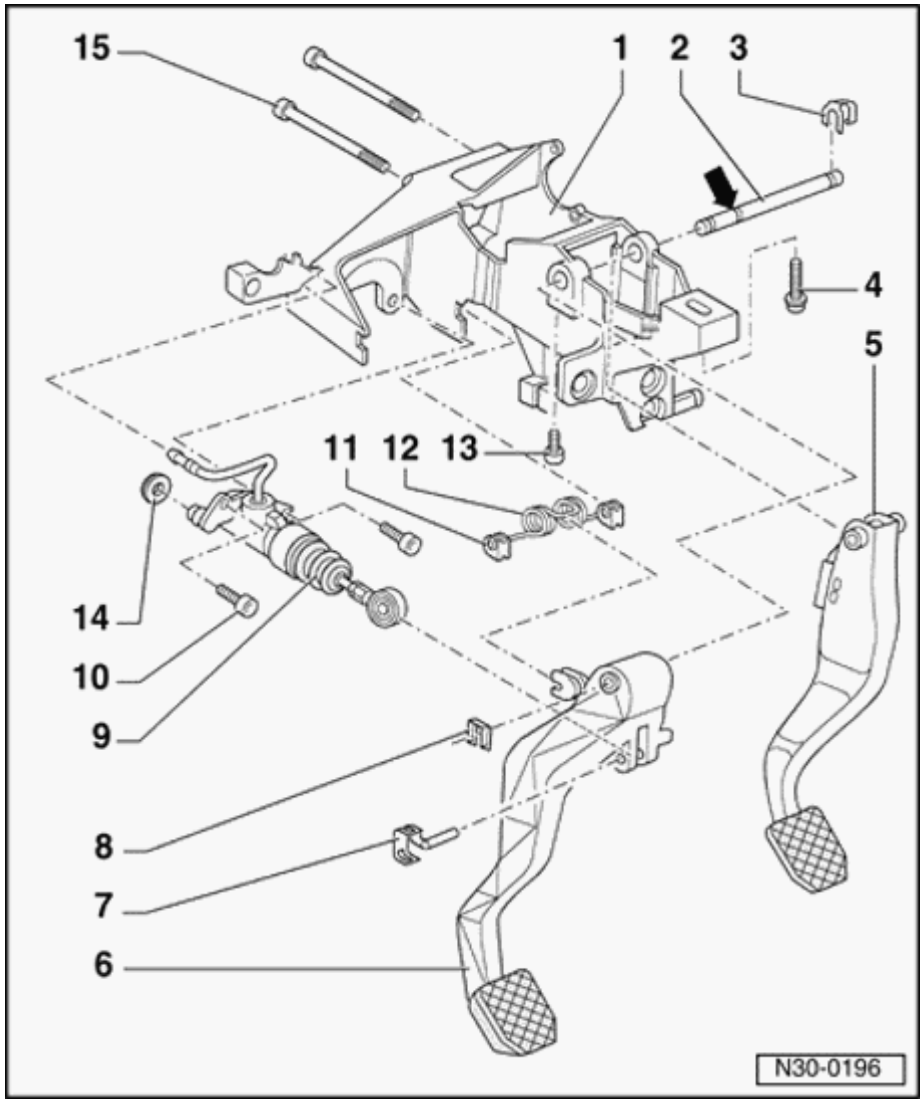
Notes:

- *Lubricate all bearings and contact surfaces with G 052 142 A 2 polycarbamide grease.*
- *Before working on the pedal cluster, remove the driver's side storage compartment*

⇒ *Repair Manual, Body Interior, Repair Group 68*

- *Make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does happen, clean the affected areas thoroughly.*

30-2



Clutch pedal and clutch control overview

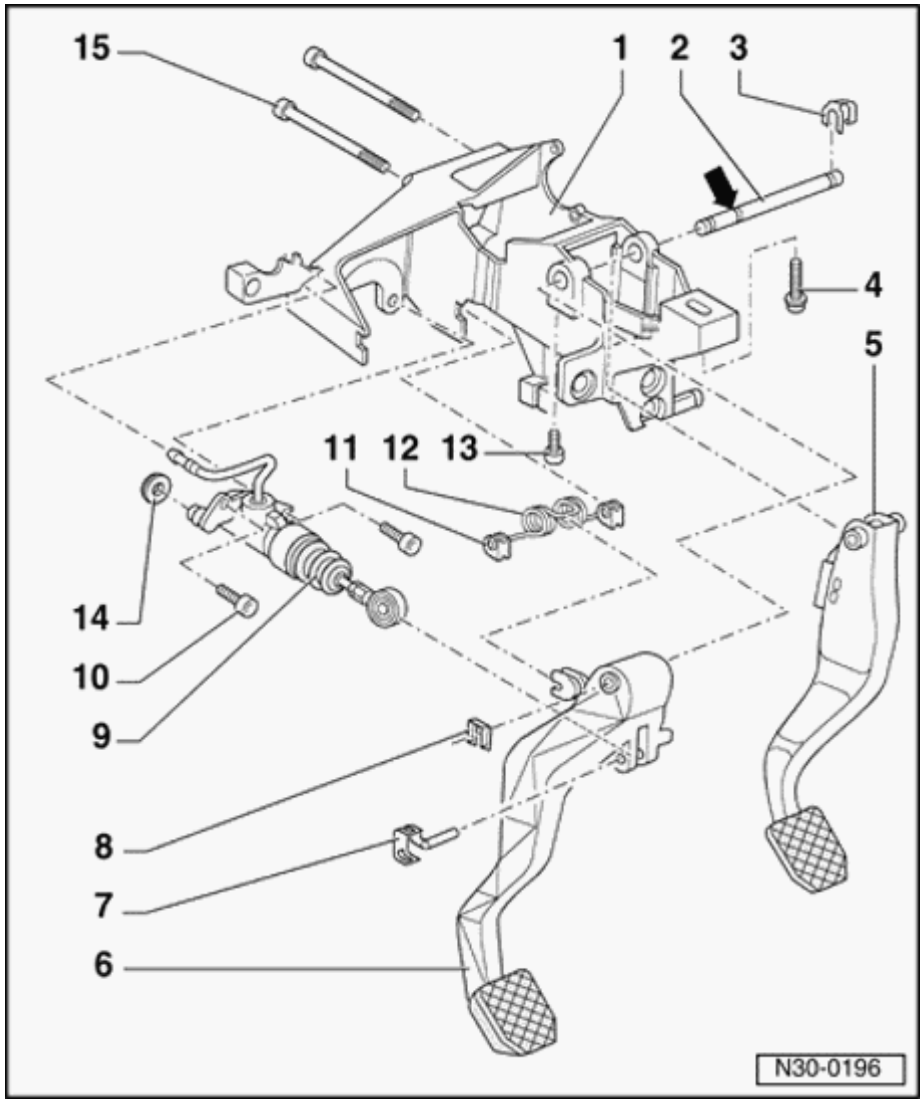
WARNING!

- ***Clutch pedal travel must not be restricted by extra carpets or floor mats.***
- ***Do not re-use fasteners that are worn or deformed in normal use.***
- ***Some fasteners are designed to be used only once, and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow recommendations in this manual-replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.***

1 - Mounting bracket

- Removing and installing ⇒ *Repair Manual, Brake System, Repair Group 46*

30-3



2 - Pivot pin

- For clutch and brake pedals
- Installation position: groove (arrow) facing clutch pedal

3 - Locking clip

4 - Socket-head bolt

- 25 Nm (18 ft lb)

5 - Brake pedal

6 - Clutch pedal

- Removing and installing ⇒ Page 30-5

7 - 8Pin and locking plate

- Clip onto clutch pedal

9 - Locking clip

10 - Clutch master cylinder

- Removing and installing ⇒ Page 30-13

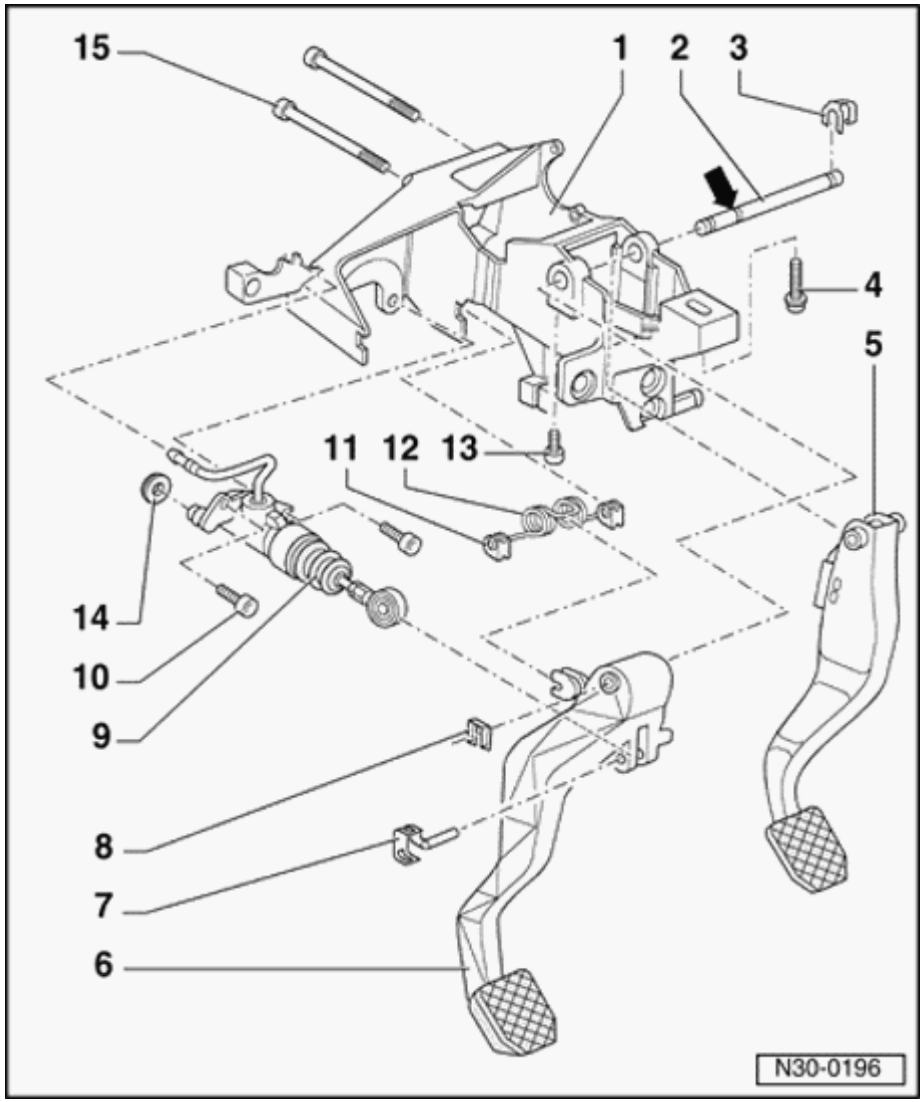
CAUTION!

Do not operate after the clutch pedal has been removed.

11 - Socket-head bolt

- 20 Nm (15 ft lb)

30-4



12 - Mount

- Insert in mounting bracket with over-center spring

13 - Over-center spring

- Application ⇒ Parts catalog microfiche
- Remove and install together with clutch pedal ⇒ Page 30-5

14 - Socket-head bolt

- 5 Nm (44 in. lb)
- Secures pivot pin for clutch and brake pedal.

15 - Seal

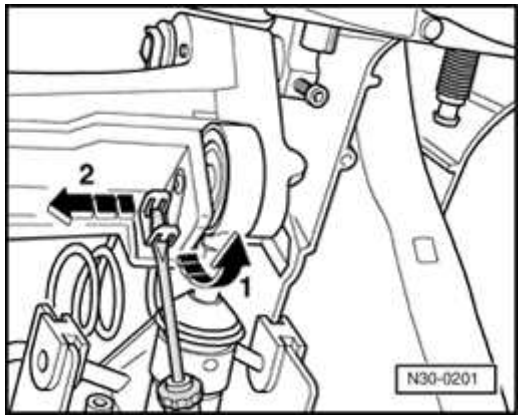
16 - Torx® bolt

- 25 Nm (18 ft lb)
- Also secures brake master cylinder to brake servo

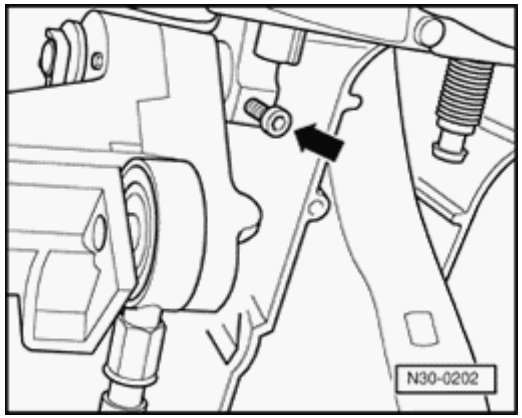
30-5

Clutch pedal and over-center spring, removing and installing

Removing



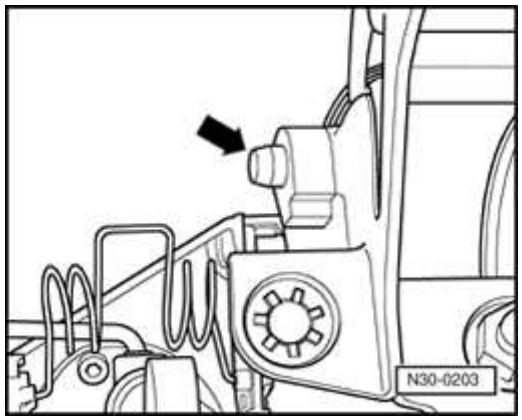
- Remove driver's side storage compartment ⇒ *Repair Manual, Body Interior, Repair Group 68*
- If installed, remove switch above clutch pedal.
- Unclip pin and locking plate using screwdriver (arrow -1-), remove pin and locking plate (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Press locking clip for clutch pedal off pivot pin using screwdriver.



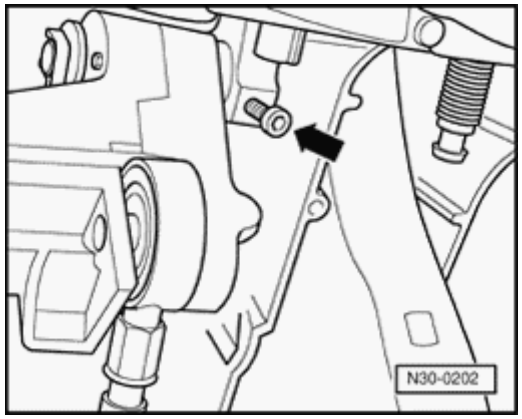
- Remove bolt (arrow).
- Press clutch and brake pedal pivot pin out toward right, until clutch pedal can be removed.
- If necessary, press locking clip for brake pedal off pivot pin using screwdriver.
- Remove clutch pedal and over-center spring.

Installing

Installation is the reverse of removal, note the following:

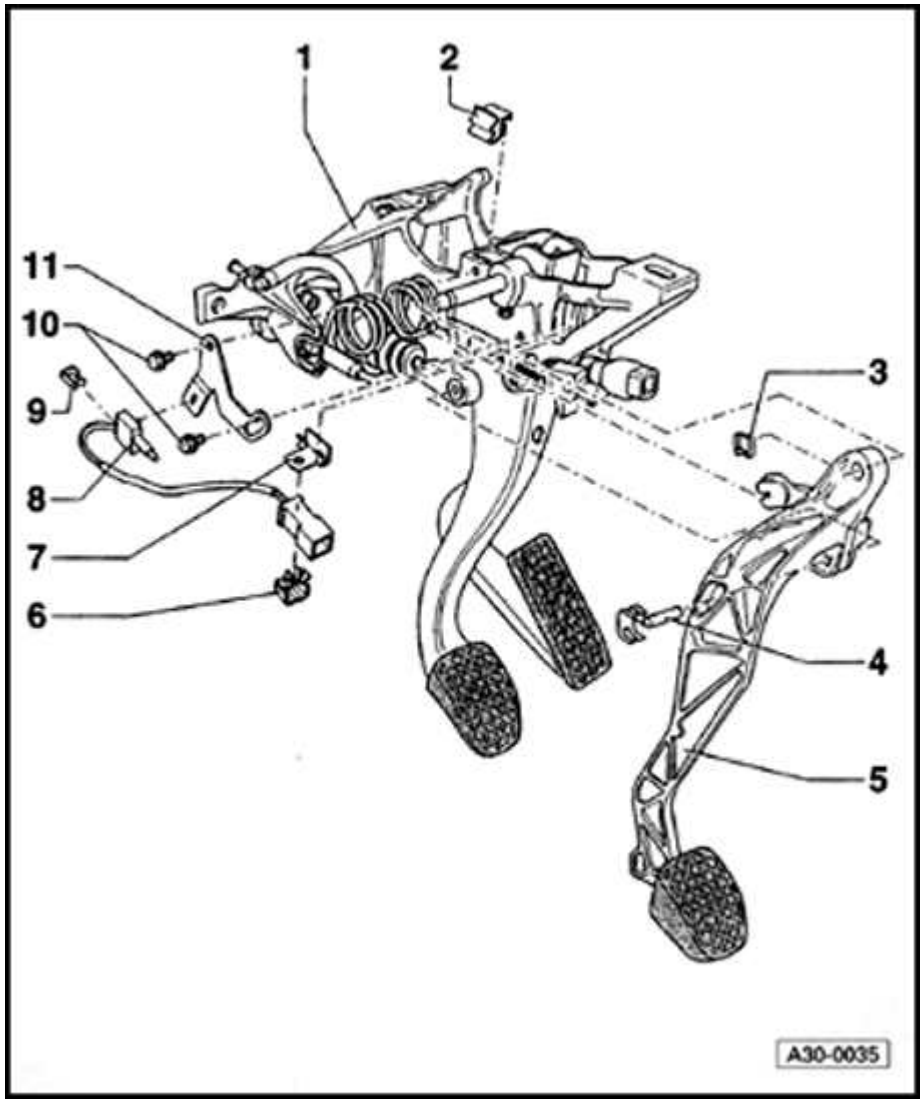


- Align pivot pin so that it protrudes out of mounting bracket on clutch pedal side (arrow).
- Hook clutch pedal into over-center spring, then install onto pivot pin.
- Connect clutch pedal to master cylinder. Clip locking pin onto clutch pedal.



- Do not tighten bolt (arrow) until both securing clips have been installed on pivot pin.

30-7



Clutch Pedal Position (CPP) switch -F194-, removing and installing

Note:

The clutch pedal position switch -F194- allows the engine to be started only with the clutch pedal depressed. Introduction 05.97 ➢

1 - Mounting bracket

- Before removing, remove steering column from steering gear ⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 48*

2 - Cable bracket

3 - Locking clip

4 - Pin and locking plate

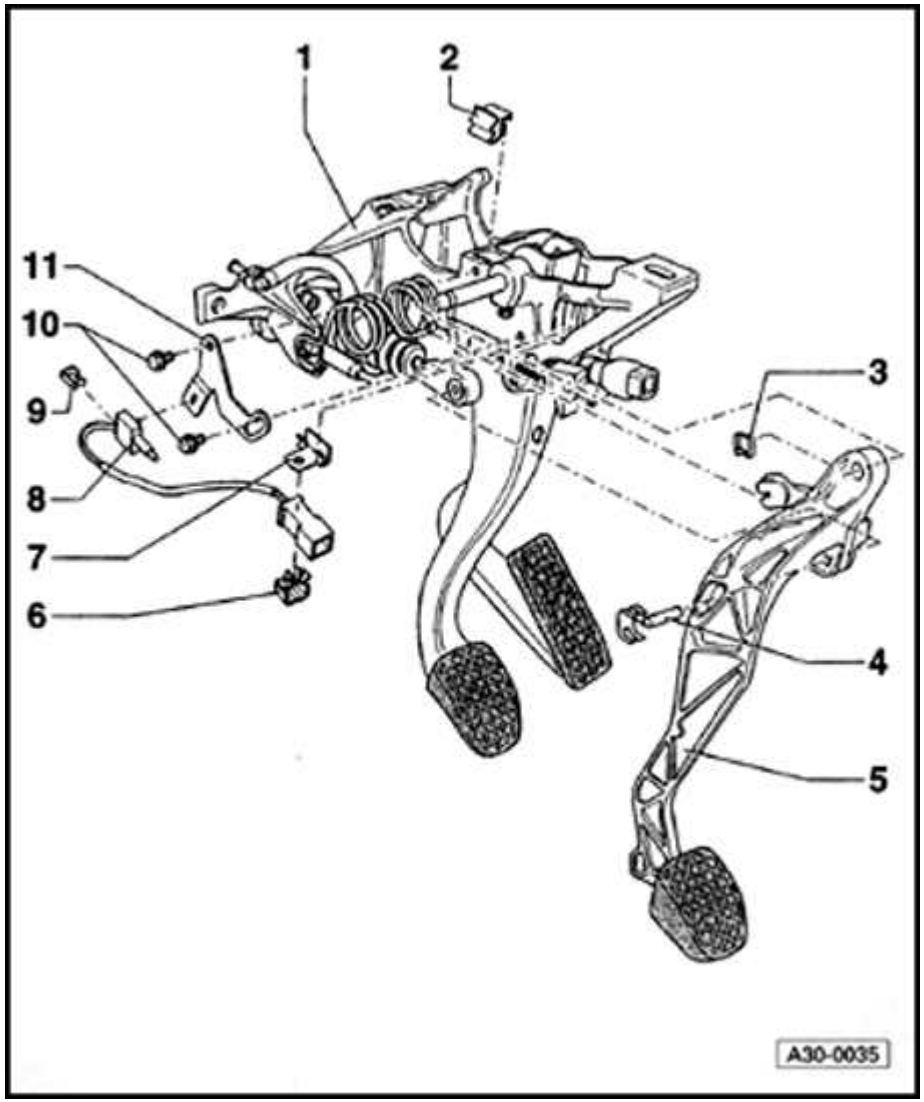
- Latched in clutch pedal

5 - Clutch pedal

- Removing and installing ⇒ Page 30-5

6 - Clip

30-8



7 - Bracket for harness connector

8 - Clutch Pedal Position (CPP) switch -F194-

- Adjusting ⇒ Page 30-9

9 - Clip

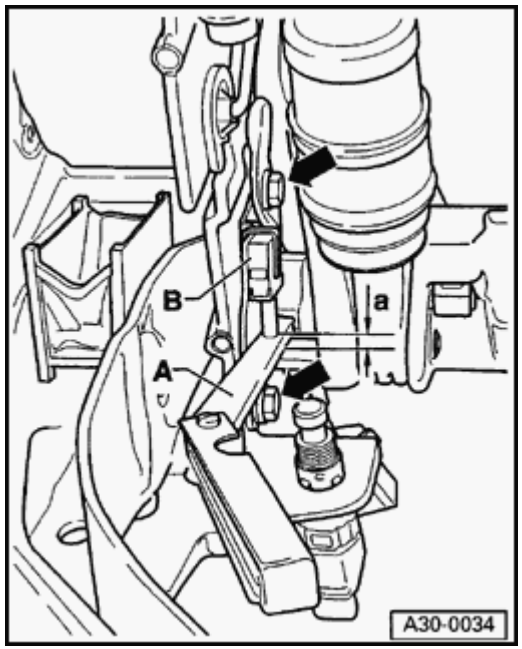
10 - Screw and washer assembly

- 8 Nm (71 in. lb)

11 - Mounting plate

30-9

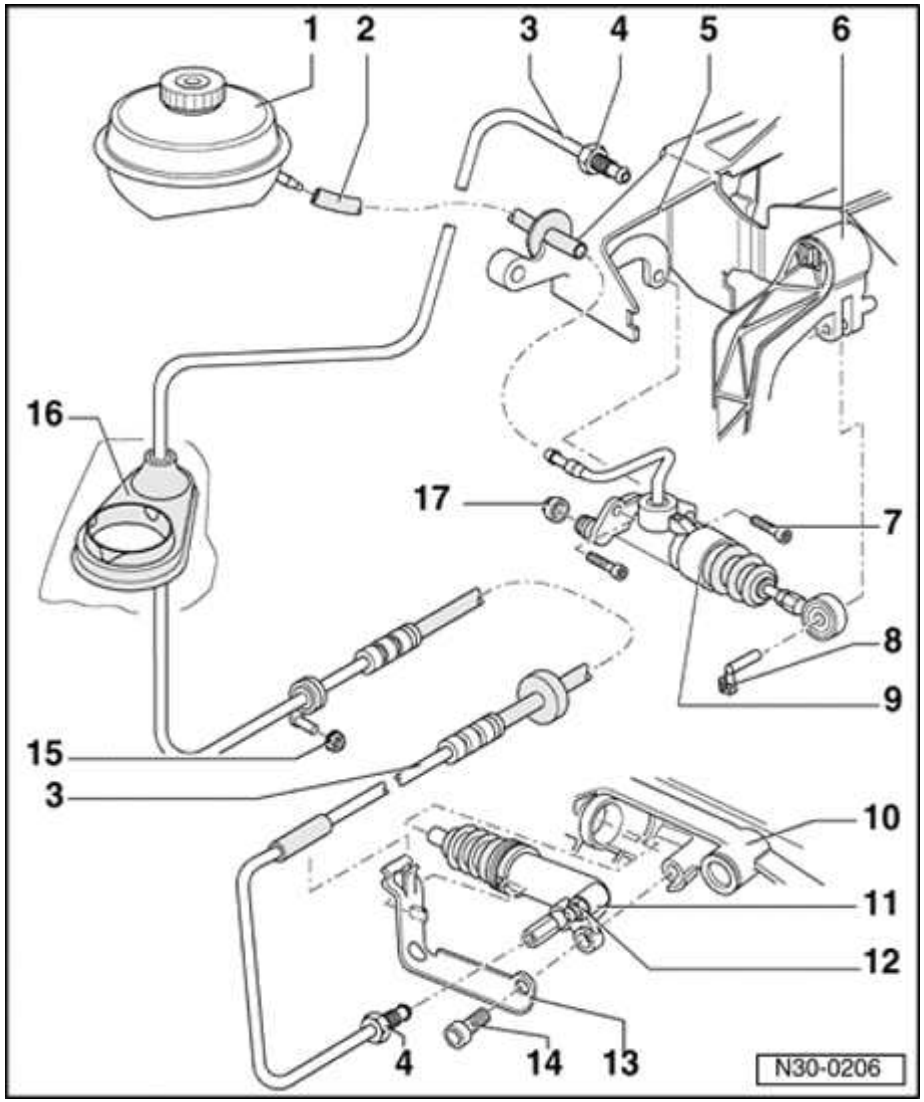
Clutch Pedal Position (CPP) switch - F194-, adjusting



- Loosen two bolts slightly (arrows).
- Have second technician fully depress clutch pedal up to stop.
- Place feeler gauge -A- with specific dimension -a- 3.2 mm (0.126 in.) between operating surface of clutch pedal and switch cam.

  Thickness -a- of feeler gauge: 3.2 mm (0.126 in.)
- Move switch -B- toward gauge -A- until stop, and tighten two mounting bolts (arrows) to 8 Nm (71 in. lb).

30-10



Clutch hydraulic system, servicing

1 - Brake fluid reservoir

2 - Supply hose

- For clutch master cylinder

3 - Hose/line assembly

- With threaded connections on clutch master cylinder and clutch slave cylinder

4 - Line fitting

- 15 Nm (11 ft lb)

5 - Mounting bracket

6 - Clutch pedal

- Removing and installing ⇒ Page 30-5

7 - Socket-head bolt

- 20 Nm (15 ft lb)

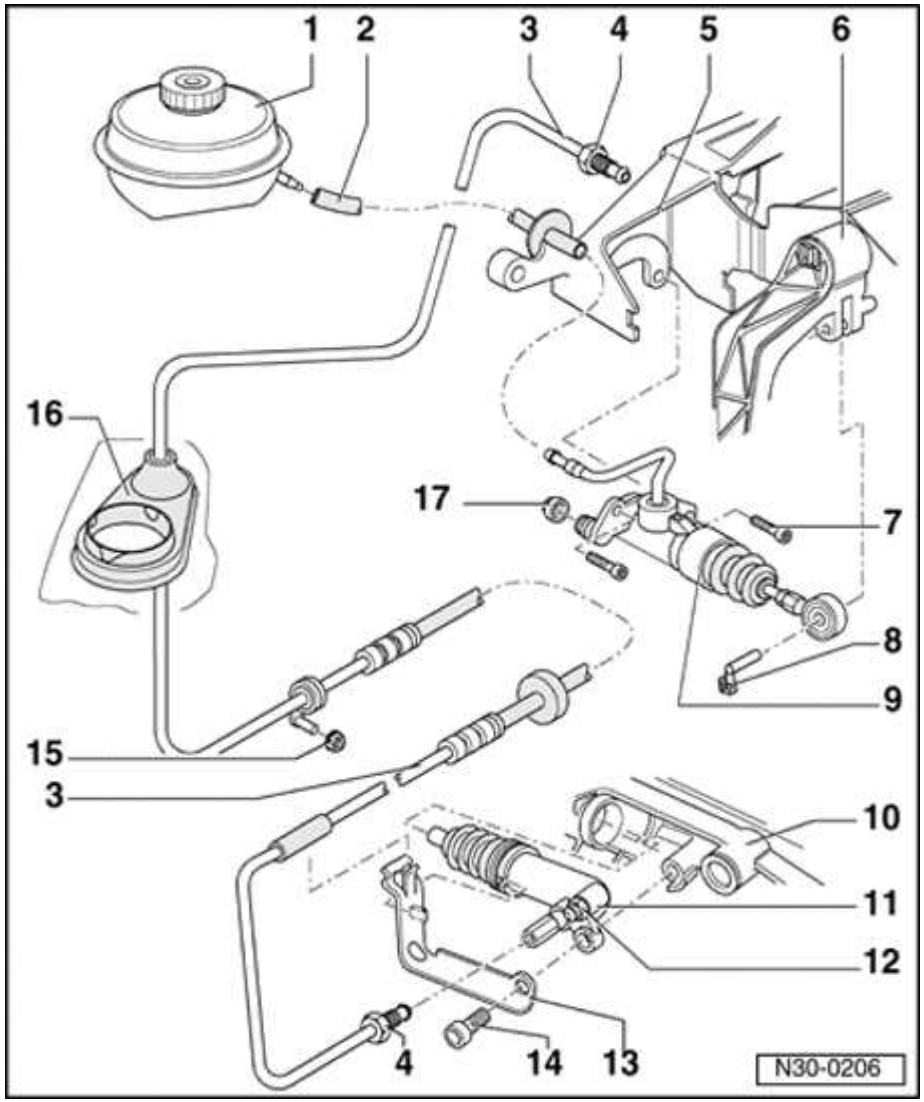
8 - 9Pin and locking plate

10 - Clutch master cylinder

- Removing and installing ⇒ Page 30-13

11 - Transmission

30-11



12 - Clutch slave cylinder

CAUTION!

Do not operate after the clutch pedal has been removed.

Brake fluid must not be allowed to get onto the transmission.

- Coat plunger of clutch slave cylinder with copper grease e.g. Z381 351 TE
- For clutch slave cylinders with plastic support ring, lightly lubricate outer surface of ring before installing
- When installing, push in until bolt can be installed

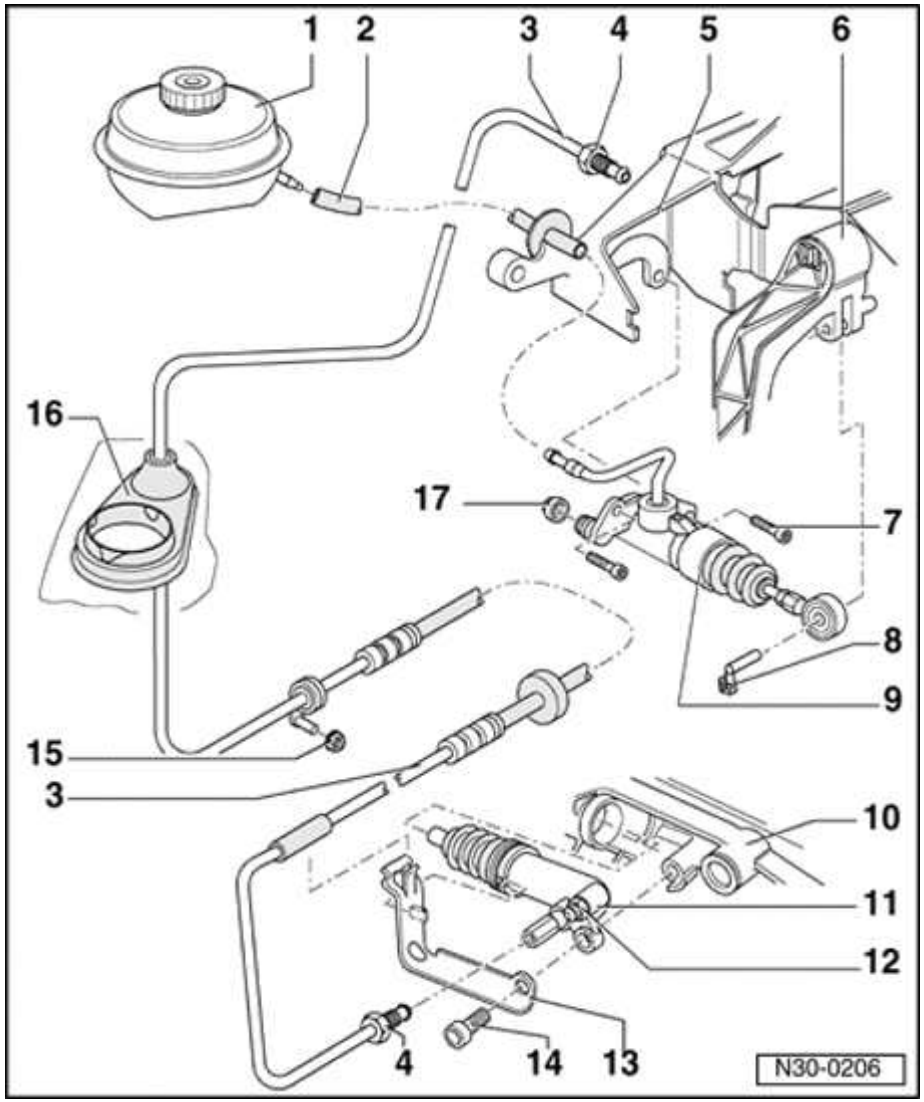
13 - Bleeder valve

- 4.5 Nm (40 in. lb)
- Observe all CAUTIONS, WARNINGS, Notes and procedures when bleeding ⇒ Page 30-17

CAUTION!

Fill the brake fluid reservoir up to the "max" marking with brake fluid before bleeding the hydraulic clutch system with the brake bleeder.

30-12



14 - Bracket

- Mounted to transmission

15 - Bolt

➢ 8DVA 000 504 bolt:

- 25 Nm (18 ft lb)

8DVA 000 505 ➢ socket-head bolt:

- 20 Nm (15 ft lb)

16 - Nut

- 2 Nm (18 in. lb)

17 - Seal

18 - Seal

- Must not be removed

30-13

Clutch master cylinder, removing and installing

Special tools and equipment

3094 hose clamp

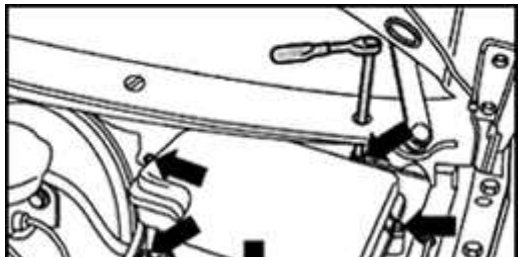
Removing

CAUTION!

Before working on the electrical system:

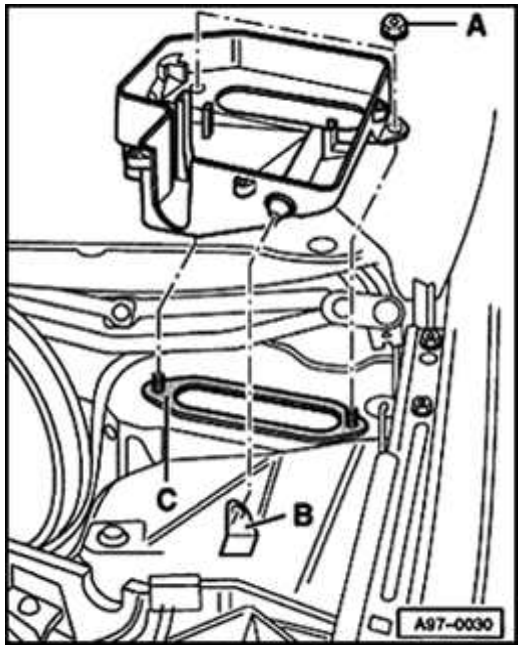
- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***
- ***Disconnect the battery Ground (GND) strap.***

To remove E-box from plenum chamber:



- Remove bolts (arrows) and remove cover.
- Remove Engine Control Module (ECM); if necessary remove 8-pin relay support ⇒ *Repair Manual, Electrical Equipment, Repair Group 97*
- Disconnect harness connectors at connector station.

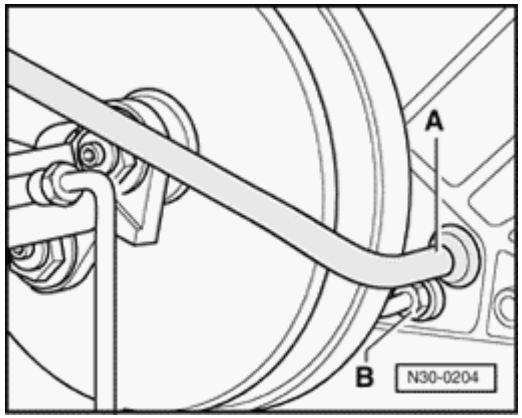
- Remove engine wiring harness together with rubber grommet from opening in E-box.



- Remove both nuts -A-
- Lift E-box out at rear of threaded bolt and remove from mounting point -B-.

CAUTION!

- ***When carrying out the following steps, make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does occur, clean thoroughly.***
- ***When working in the area of the footwell, make sure to protect the carpeting from brake fluid which may run out.***



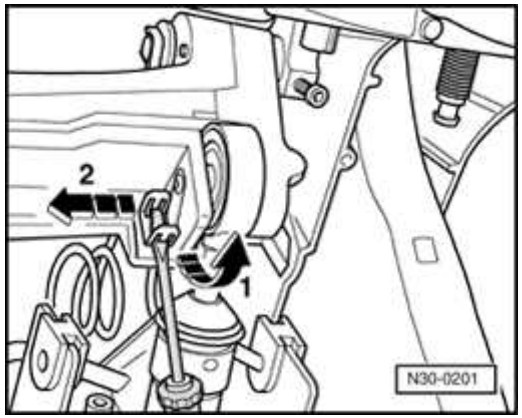
- Clamp supply hose -A- from brake fluid reservoir using 3094 hose clamp. Pull hose off clutch master cylinder and plug hose.
- Disconnect line -B- from clutch master cylinder and seal.

30-15

- Remove driver's side storage compartment

  ⇒ *Repair Manual, Body Interior, Repair Group 68*

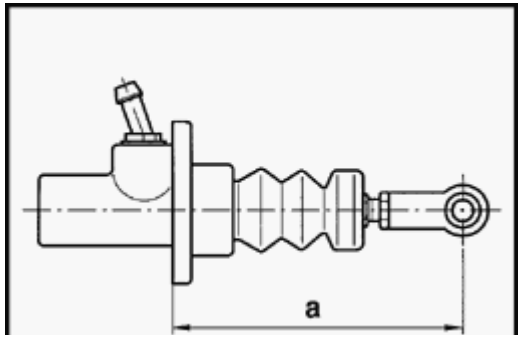
- Remove switch above clutch pedal if installed ⇒ Page 30-7



- Unclip pin using screwdriver (arrow -1-), pull out pin (arrow -2-), and detach clutch pedal from clutch master cylinder.
- Unbolt clutch master cylinder from passenger compartment.

Installing

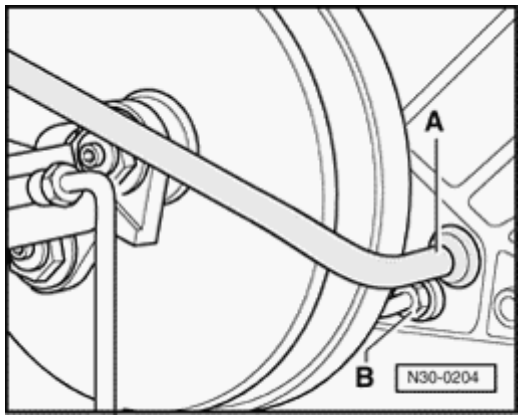
Installation is the reverse of removal, note the following:



- When replacing clutch master cylinder, check dimension -a- on ball head and adjust if necessary.

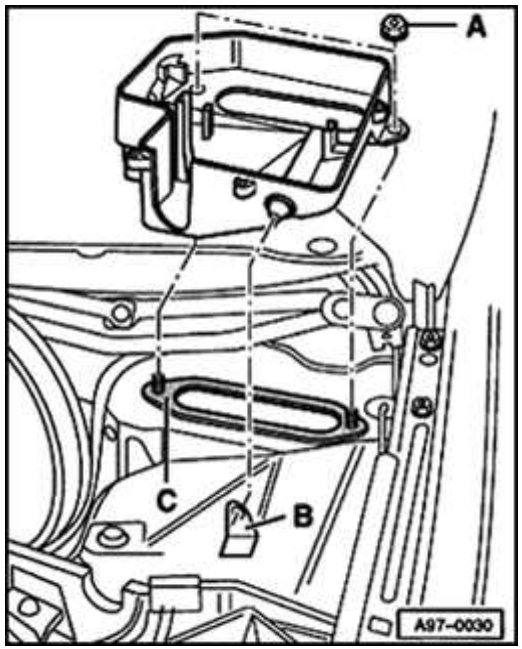
  Dimension -a- = 165 ± 0.5 mm (6.496 ± 0.020 in.)

- Connect clutch master cylinder to clutch pedal.
  Secure pin and locking plate on clutch pedal.



- Tighten line fitting -B- to clutch master cylinder to 15 Nm (11 ft lb).
- Slide hose -A- onto brake fluid reservoir up to stop.
- Bleed hydraulic clutch system after installing clutch master cylinder ⇒ Page 30-17 .

To install E-box in plenum chamber:



- Always replace seal -C-.
- Make sure seal is positioned properly, and does not cover opening or stepped metal edge.
- Install E-box by hand and evenly tighten nuts -A- to 4 Nm (35 in. lb) (i.e. imprint on E-box cover).

30-17

Clutch system, bleeding

Special tools and equipment

- VAG1238B brake filling and bleeding appliance
  or
- VAG1869 brake filling and bleeding appliance

WARNING!

Brake fluid is poisonous.

- ***It must NEVER be removed by siphoning with your mouth.***
- ***If brake fluid contacts skin or eyes, flush or wash adequately to prevent irritation. Get medical attention immediately if necessary.***
- ***Brake fluid must be disposed of properly.***

CAUTION!

- ***Use only fresh brake fluid conforming to US standard FMVSS 116 DOT 4. Genuine VW/Audi brake fluid conforms to this specification.***
- ***Brake fluid must never be brought into contact with liquids containing mineral oil (gasoline, cleaning agents). Mineral oil damages the pistons and cups in the braking system.***
- ***Brake fluid must not be allowed to come into contact with paintwork because of its caustic effect.***
- ***Brake fluid is hygroscopic (i.e. it absorbs moisture from the surrounding air) and should therefore always be kept in airtight containers.***
- ***When carrying out the following steps, make sure that no brake fluid escapes onto the transmission.***

Notes:

- *The clutch system must be bled after carrying out work on the hydraulic clutch mechanism.*

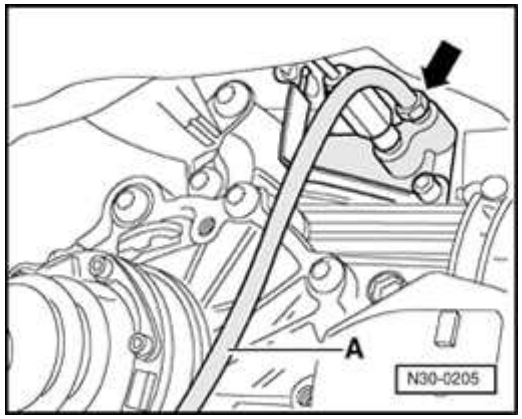
- *Top-off brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.*

- Pull clutch pedal back to rest position.

- Connect VAG1238B brake filling and bleeding appliance or VAG1869 but do not switch on.

- If necessary, remove noise insulation panel under transmission.

30-19



- Connect bleeder hose -A- to clutch slave cylinder (arrow) and open bleeder valve.
- Connect bleeder hose with pressure hose to collector bottle.
- Switch on bleeding appliance and let approx. 100 cm3 (approx. 3.4 fl. oz) brake fluid flow into suitable collection reservoir.

CAUTION!

Always comply with disposal regulations.

Work pressure 2.5 bar (36 psi)

Note:

While bleeding, make sure bleeder hose remains correctly routed.

- Close bleeder valve.

  Tightening torque: 4.5 Nm (40 in. lb).
- Depress clutch pedal several times after completion of bleeding process.
- Bleed system again if necessary.

30-1

Clutch mechanism, servicing

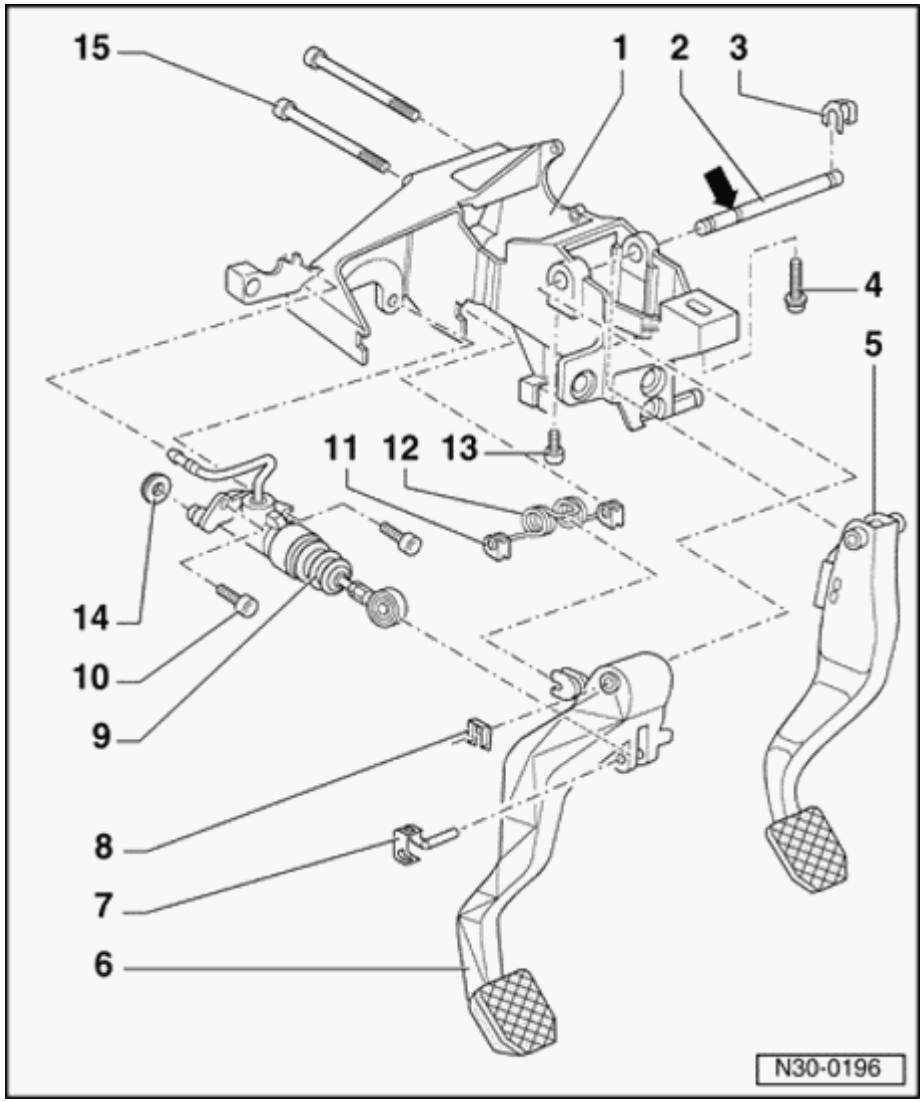
Note:

- *For vehicles with coded radio, obtain and note the radio code.*
- *Disconnect battery Ground strap with the ignition switched off.*
- *Lubricate all bearings and contact surfaces with G 052 142 A 2 polycarbamide grease.*
- *Before working on pedal cluster, remove cover below dash panel:*

⇒ *Repair Manual, Body Interior, Repair Group 68*

- *Make sure that no brake fluid escapes into the footwell, the plenum chamber or onto the transmission below. If this does happen, clean the affected areas thoroughly.*
- *When performing work in the footwell, put cloths on the carpet to protect it from possible brake fluid spills.*

30-2



Pedal cluster, assembly overview

1 - Mounting bracket

- Detach steering column from steering box before removing

⇒ *Repair Manual, Brake System, Repair Group 46*

2 - Pivot pin

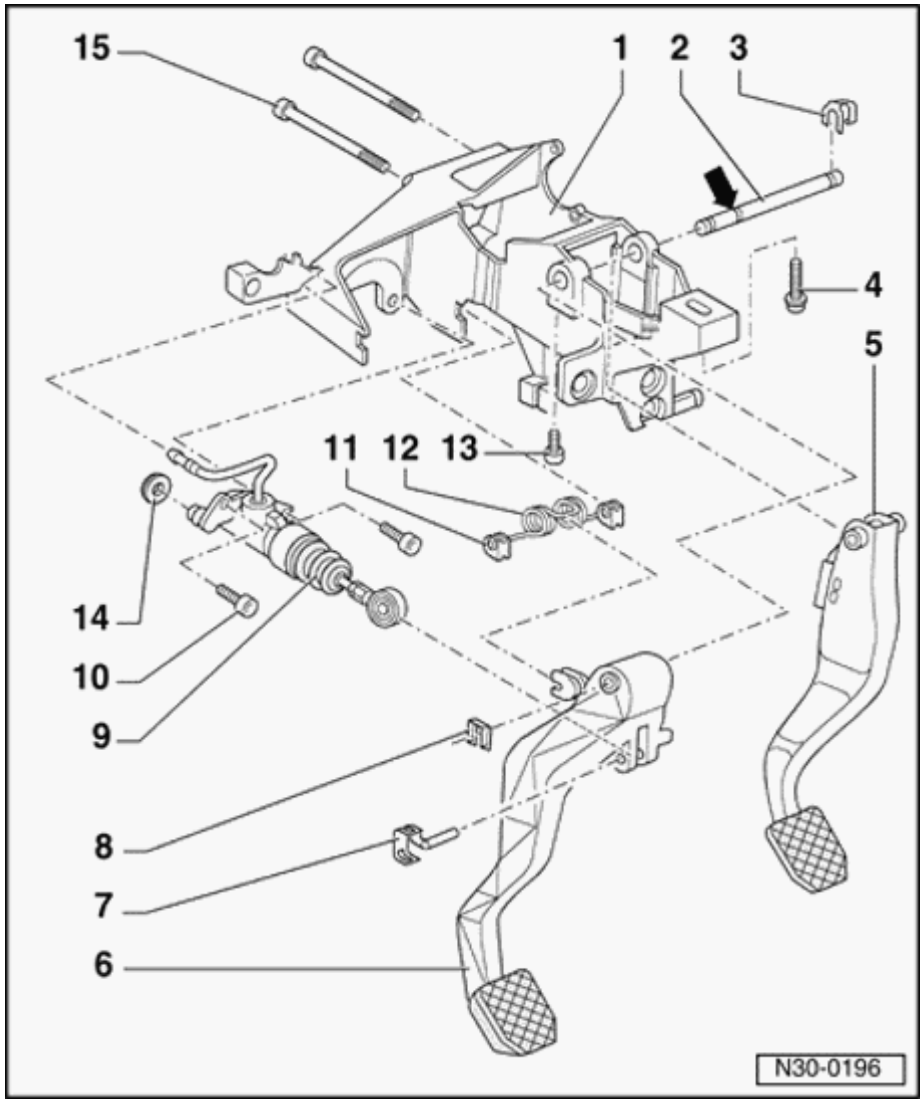
- For clutch pedal and brake pedal
- Installation position: groove (arrow) towards clutch pedal

3 - Locking clip

4 - Hex socket head bolt, 25 Nm

5 - Brake pedal

30-3



6 - Clutch pedal

- Removing and installing ⇒ Page 30-5

7 - Pin

- Clip onto clutch pedal

8 - Locking clip

9 - Master cylinder

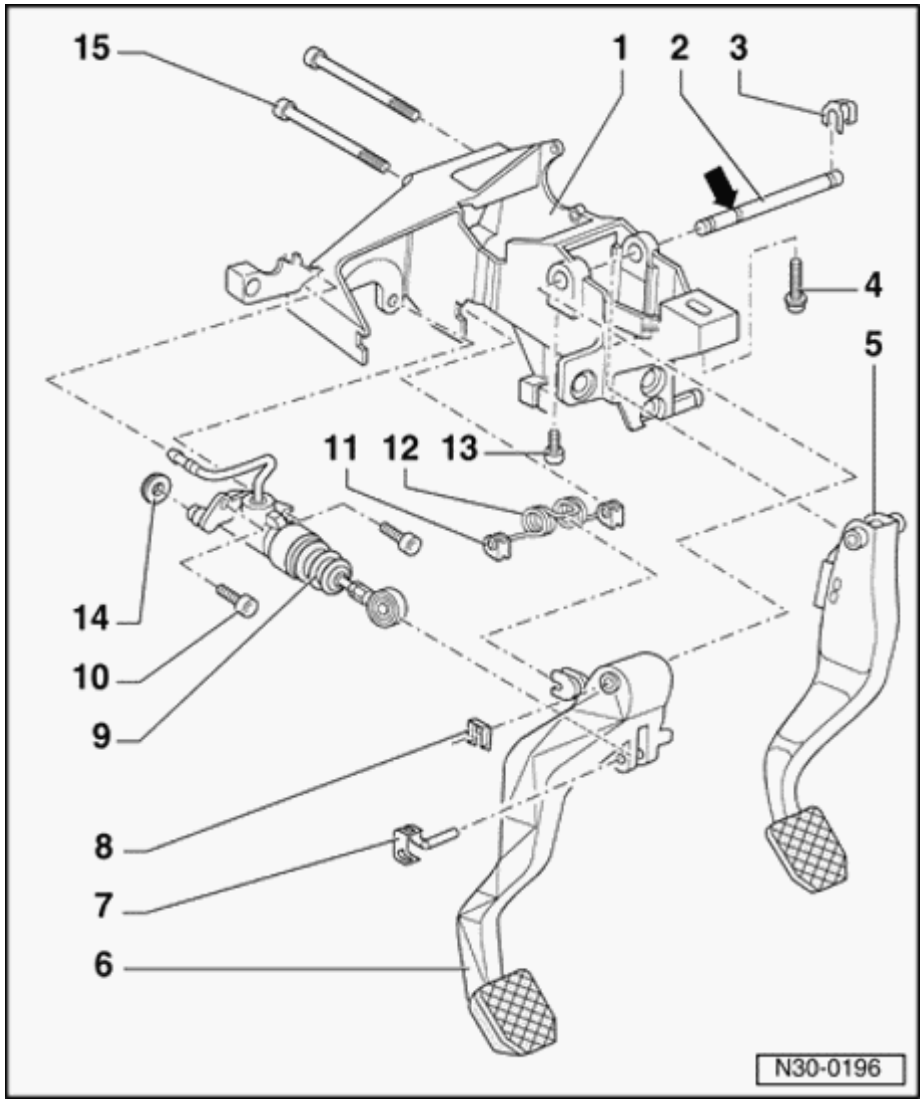
- Removing and installing ⇒ Page 30-17
- Do not operate clutch pedal after slave cylinder has been removed.

10 - Hex socket head bolt, 20 Nm

11 - Mounting

- Insert in mounting bracket with over-center spring

30-4



12 - Over-center spring

- Allocation

⇒ *Parts catalog*

- Remove and install with clutch pedal ⇒ Page 30-5

13 - Hex socket head bolt, 5 Nm

- Secures clutch and brake pedal pivot pin

14 - Seal

- Must not be removed

15 - Torx bolt - 25 Nm

- Also secures the brake master cylinder with brake servo

30-5

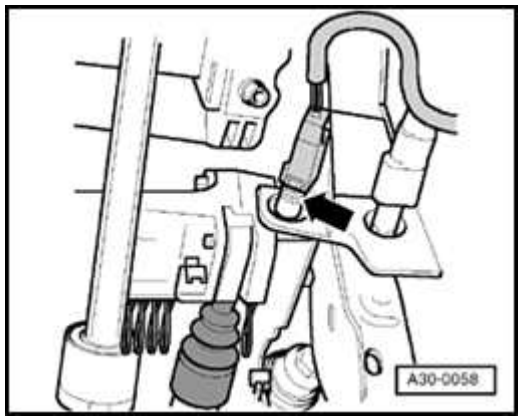
Clutch pedal and over-center spring, removing and installing

Removing

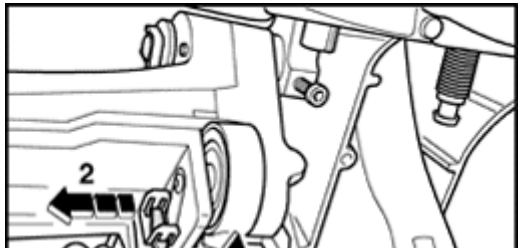
- Remove driver's side storage compartment:

⇒ *Repair Manual, Body Interior, Repair Group 68*

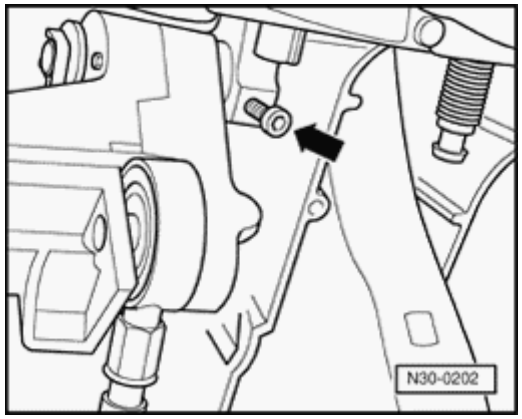
Note:



- *For the following procedures, make sure that the clutch pedal does not press out switch (arrow) from securing clip, since the thread of the switch would be damaged and the switch would have to be replaced.*
- *To ensure proper securing, the switch (arrow) may only be installed once.*



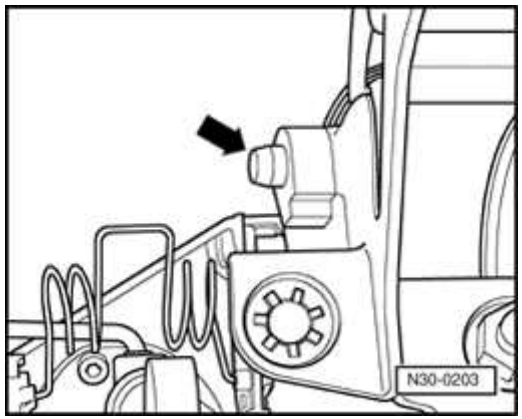
- Detach clutch pedal from master cylinder. To do this, unclip pin using a screwdriver (arrow -1-) and pull out pin (arrow -2-).
- Press clutch pedal securing clip off pivot pin with a screwdriver.



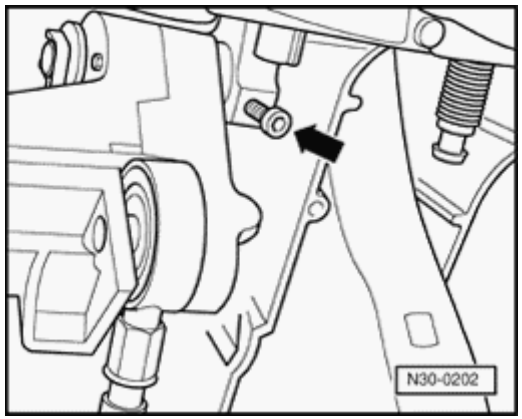
- Unscrew bolt (arrow).
- Press clutch and brake pedal pivot pin out to the right, until the clutch pedal can be removed.
- If necessary press brake pedal securing clip off pivot pin with a screwdriver.
- Take out clutch pedal and over-center spring.

Installing

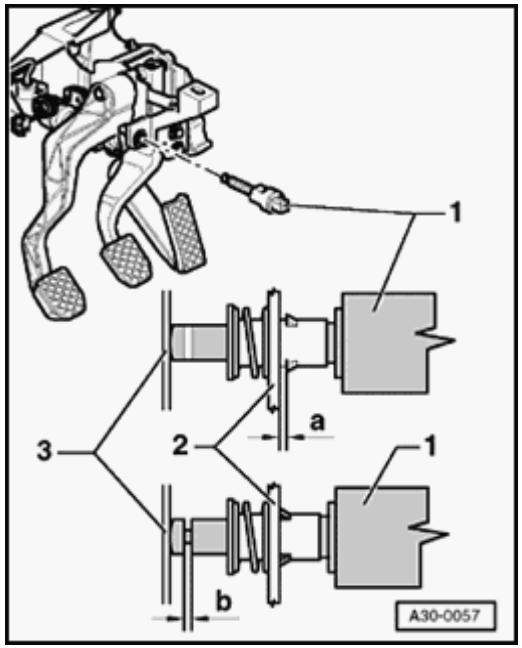
Installation is carried out in the reverse order,
when doing this note the following:



- Align clutch pedal/brake pedal pivot pin so that it protrudes out of mounting bracket at clutch pedal side (arrow).
- Hook clutch pedal into over-center spring, then fit onto pivot pin.
- Connect clutch pedal to master cylinder. Clip pin onto clutch pedal.



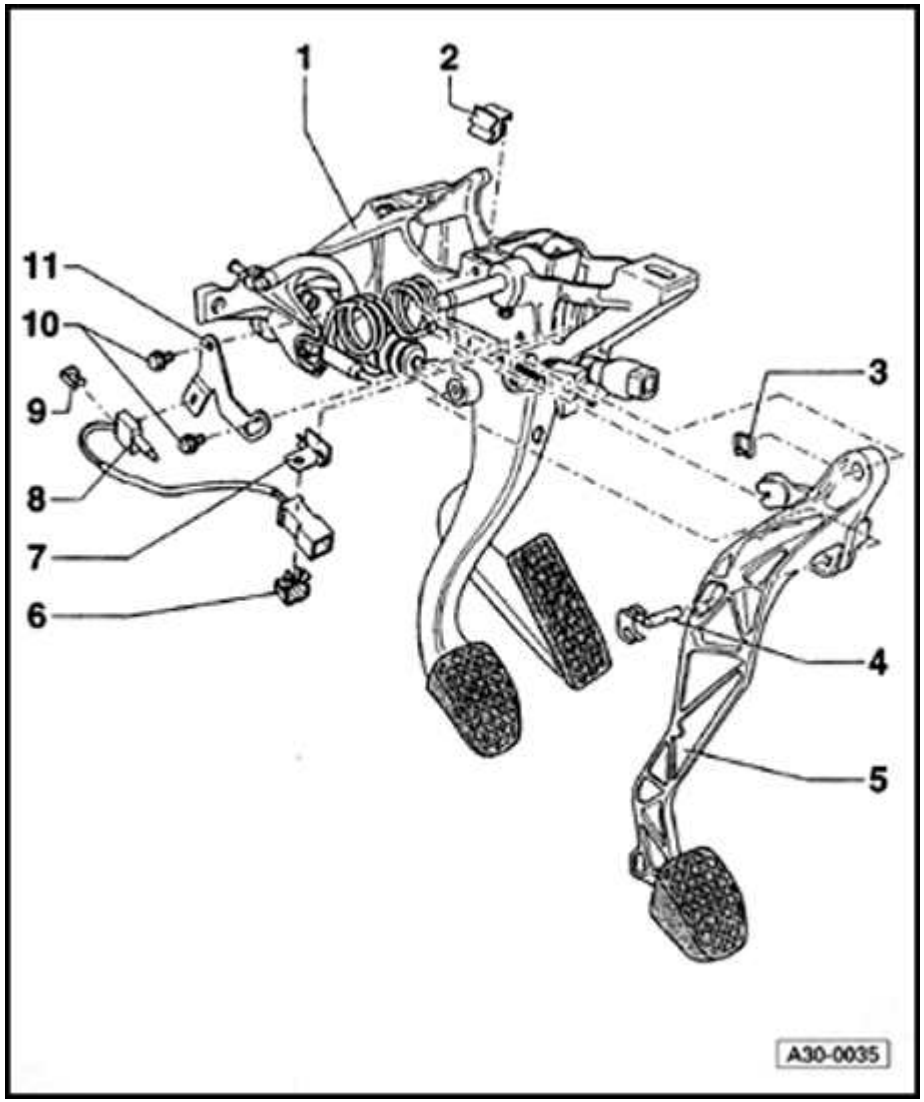
Do not tighten bolt (arrow) until both securing clips have been fitted on the clutch pedal/brake pedal pivot pin.



- Check adjustment of switch -1- via clutch pedal as follows:
  - Switch -1- must sit completely against clutch pedal -3- and must be completely activated.
  - Adjustment specification: The gap measurement -a- between securing clip and mounting bracket -2- or gap measurement -b- at switch -1- be no larger than 0.5 mm.
  - To adjust, clamp must be held and switch -1- must be turned.

Note:

To ensure proper securing, the switch may only be installed once.



Clutch Pedal Position (CPP) switch -F 194-, removing and installing

Note

The clutch pedal position (CPP) switch -F194- ensures that the engine can only be started with the clutch pedal depressed.

1 - Mounting bracket

2 - Cable bracket

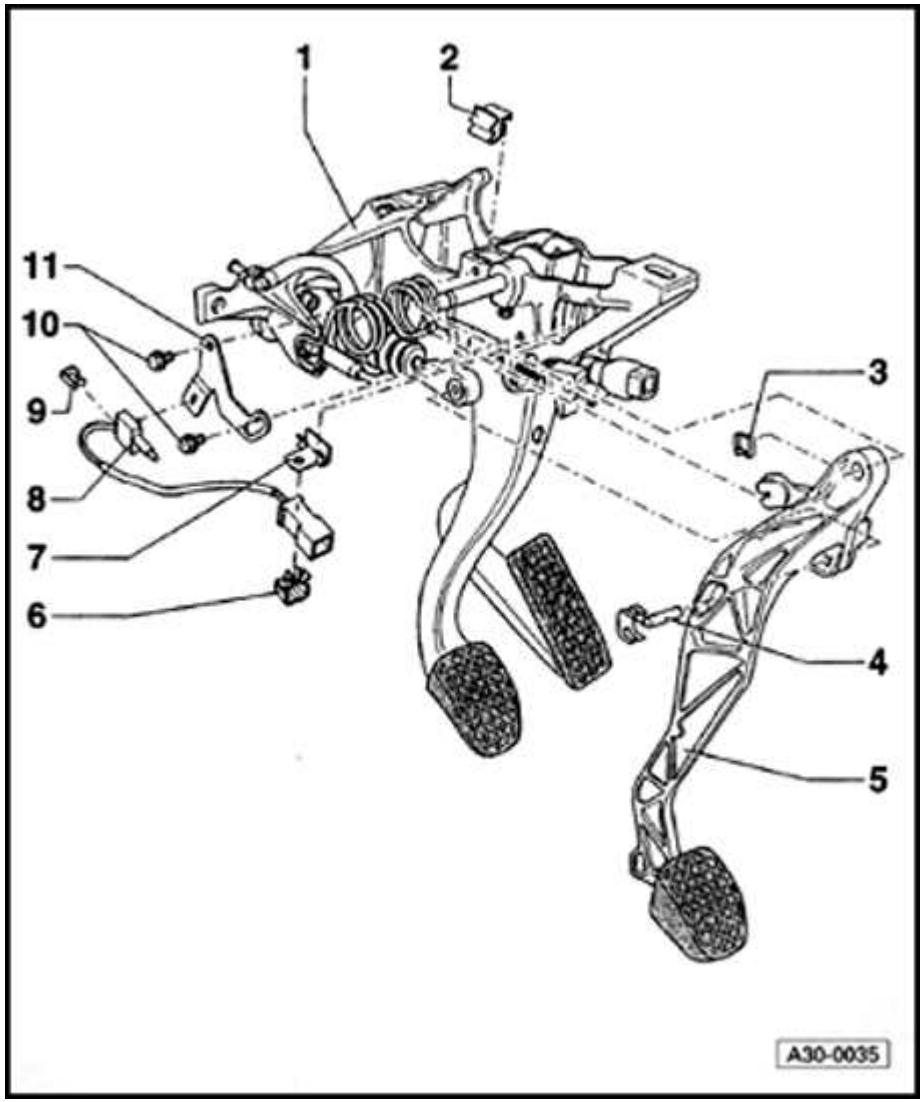
3 - Fuse

4 - Bolt

- Lock into clutch pedal

5 - Clutch pedal

- Removing and installing ⇒ Page 30-5



6 - Clip

7 - Harness connector bracket

8 - Clutch Pedal Position (CPP) Switch -F 194-

- Adjusting ⇒ Page 30-11

9 - Clip

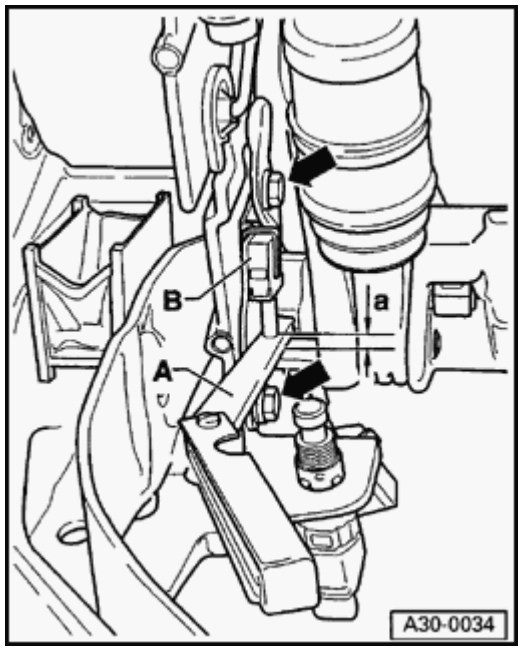
10 - Screw and washer assembly

- 8 Nm

11 - Securing plate

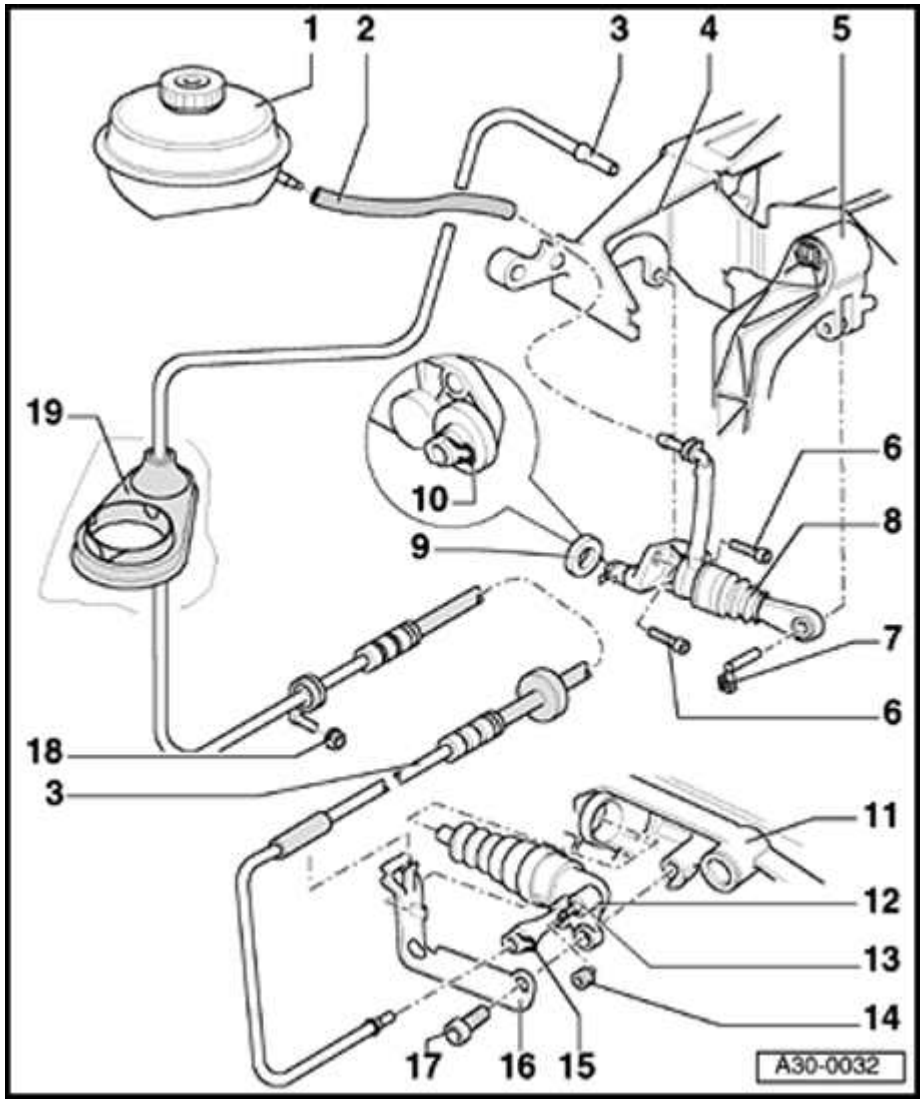
30-11

Clutch Pedal Position (CPP) switch - F194-, adjusting



- Loosen two bolts (arrow) slightly.
- Have second technician depress clutch pedal to stop.
- Insert feeler gauge -A-, with selected measurement -a- 3.2 ± 0.2 mm, between activation surface of clutch pedal and switch plunger.
- Tilt switch -B- toward feeler gauge -A- to stop and tighten both securing bolts (arrows) to 8 Nm.

30-12



Hydraulic system, general layout

1 - Brake fluid reservoir

2 - Supply hose

3 - Line/hose assembly

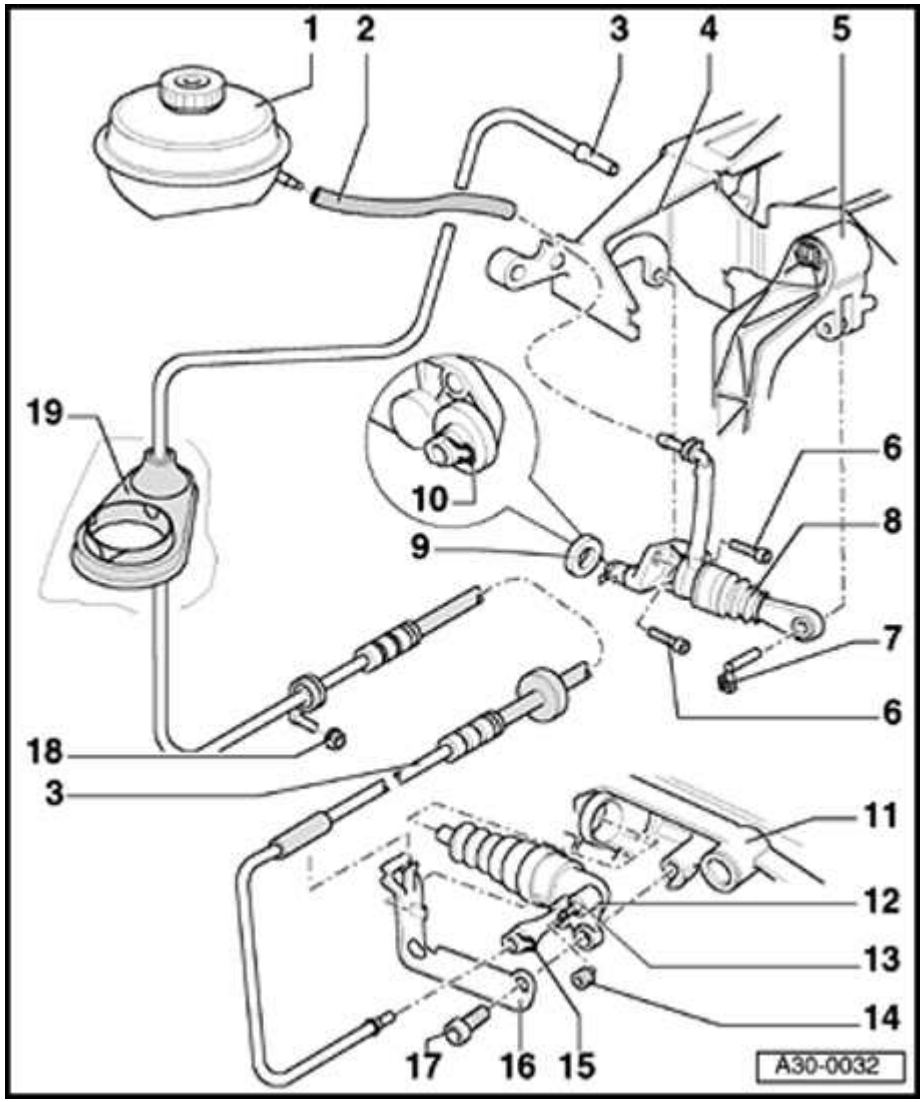
- For plug-in connections on master cylinder and slave cylinder
- Disconnecting from master cylinder and installing ⇒ Page 30-18
- Disconnecting from slave cylinder ⇒ Fig. 2
- Allocation

⇒ *Parts catalog*

4 - Mounting bracket

5 - Clutch pedal

- Removing and installing ⇒ Page 30-5



6 - Hex socket head bolt, 20 Nm

7 - Pin

8 - Master cylinder

- With plug-in connection for hose/line assembly
- Removing and installing ⇒ Page 30-17

9 - Seal

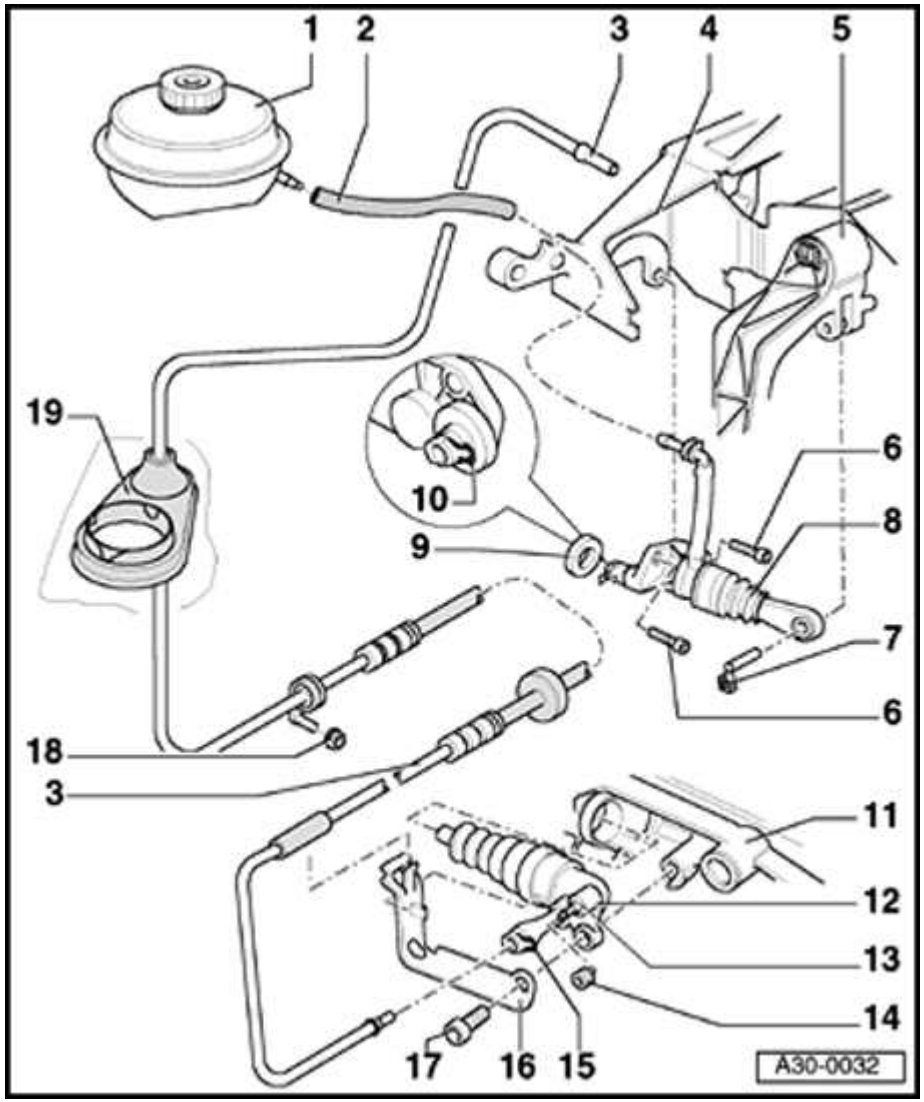
- Must not be removed

10 - Retaining clip

- Pull out retaining clip to disconnect line ⇒ Page 30-18

11 - Transmission

30-14



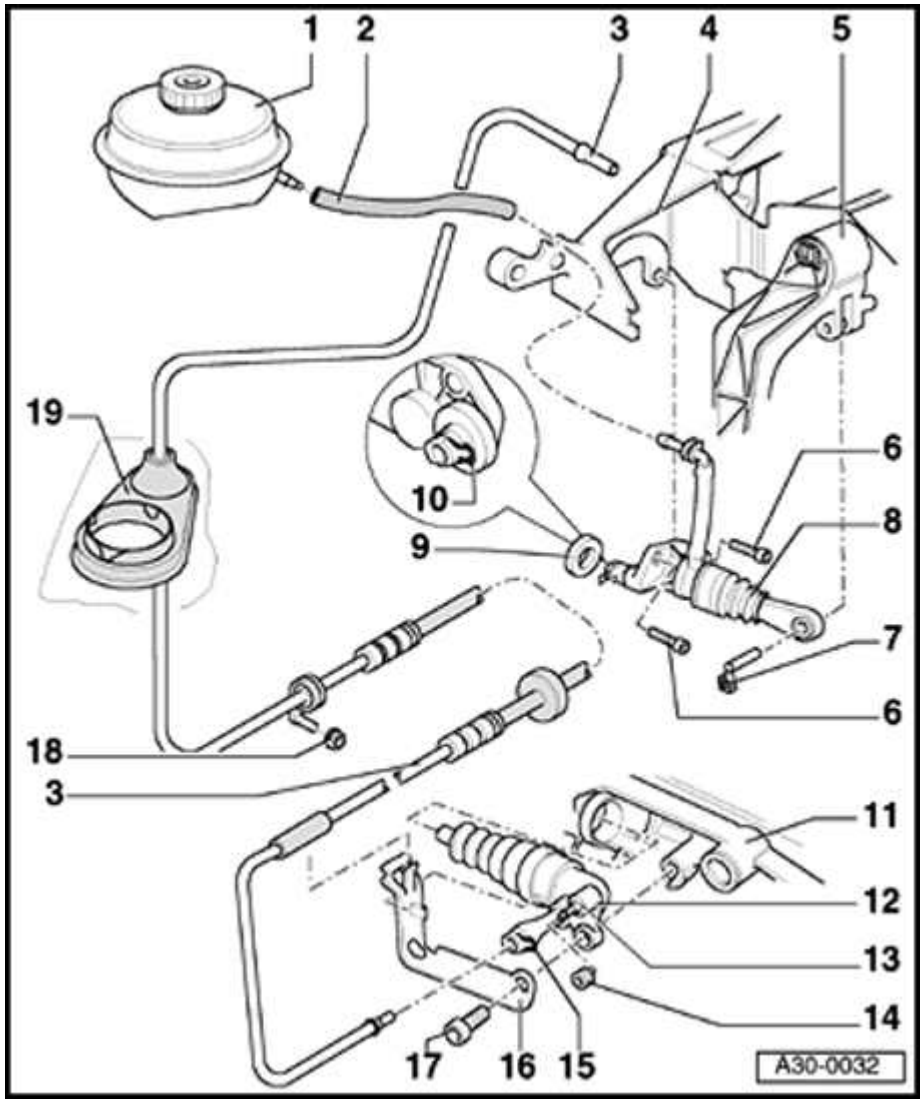
12 - Plastic slave cylinder

- Do not operate clutch pedal after slave cylinder has been removed
- Brake fluid must not be allowed to get onto the transmission
- Lightly grease to install ⇒ Fig. 1
- When installing push in until the securing bolt can be fitted.
- With plug-in connection for hose/line assembly
- Disconnecting hose/line assembly ⇒ Fig. 2
- Follow correct sequence of work when bleeding ⇒ Page 30-25 .

13 - Bleeder valve

- Tighten to 4.5 Nm
- Follow correct sequence of work when bleeding ⇒ Page 30-25
- A broken off bleeder valve can be removed using a 3mm hex socket wrench

30-15



14 - Dust cap

15 - Retaining clip

- Pull out retaining clip to disconnect line ⇒ Fig. 2

16 - Bracket

- Secured to transmission

17 - Hex socket head bolt

- 20 Nm

18 - Nut

- 2 Nm

19 - Seal

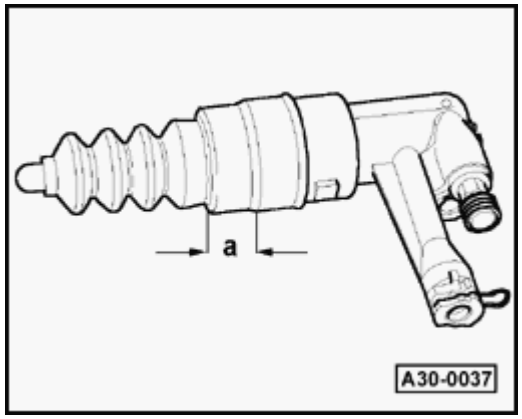


Fig. 1 Installing clutch slave cylinder

- Coat area -a- of collar with lithium grease G 052 150 A2 before installing slave cylinder into transmission housing.
- Lightly coat contact surface for plunger to clutch release lever with copper grease, e.g. Z 381 351 TE.

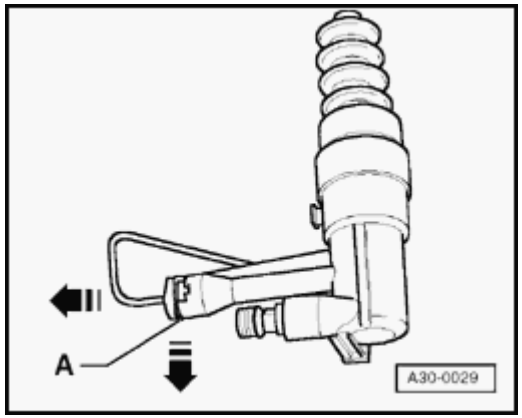


Fig. 2 Disconnecting line and clutch slave cylinder

Removing

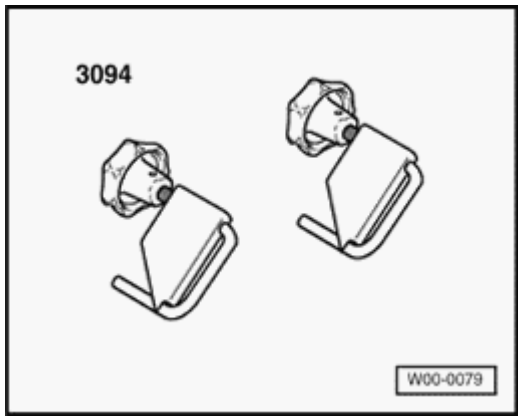
- To disconnect line, use a screwdriver to pry out retaining clip -A- so that it clicks. Line can then be pulled out.

Installing

- Press in retaining clip -A- as far as it will go.
- Push line into slave cylinder until it engages audibly.

Master cylinder, removing and installing

Special tools, testers and auxiliary items

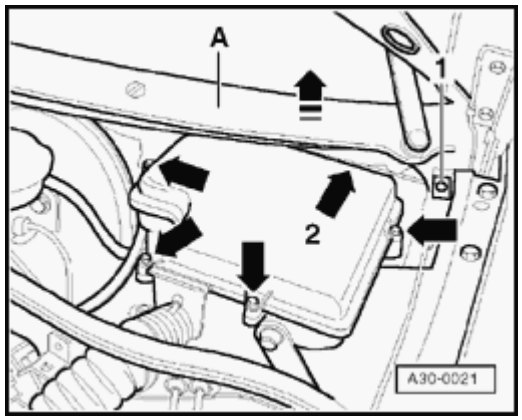


- Hose clamp 3094

Removing

- If installed, remove cover above plenum chamber.
- Disconnect battery Ground (GND) strap with the ignition switched off.

Remove E-Box from plenum chamber as follows:

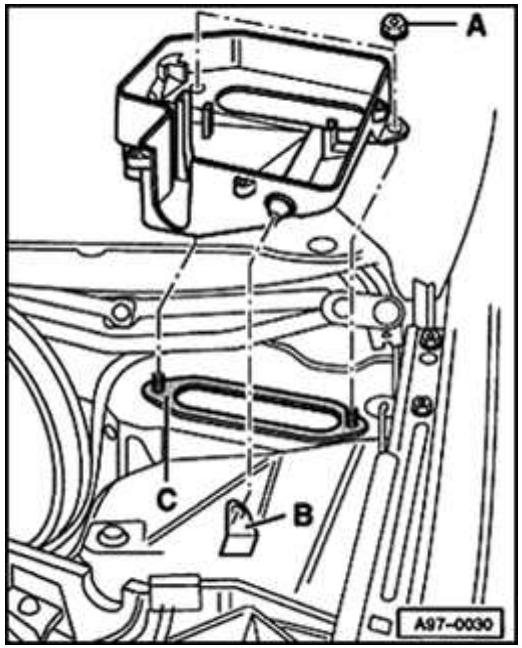


- Pull off clip -1- and lift wind grill -A- slightly. Now remove screw (arrow -2-).
- Remove remaining screws (arrows) and remove cover.
- Remove engine control unit and 8-point relay carrier (if fitted)

⇒ *Repair Manual, Electrical Equipment, Repair Group 97*

- Unplug connector in connector station.
- Pull engine wiring harness together with rubber grommet out through opening in electronics box.

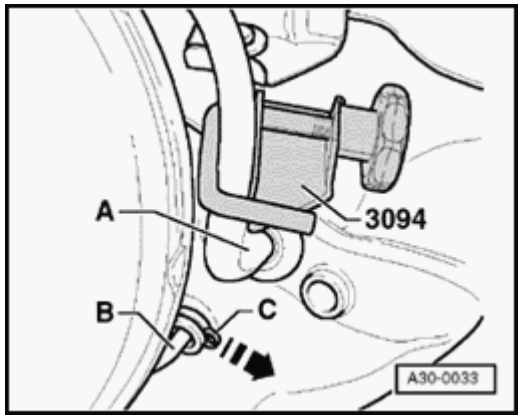
30-18



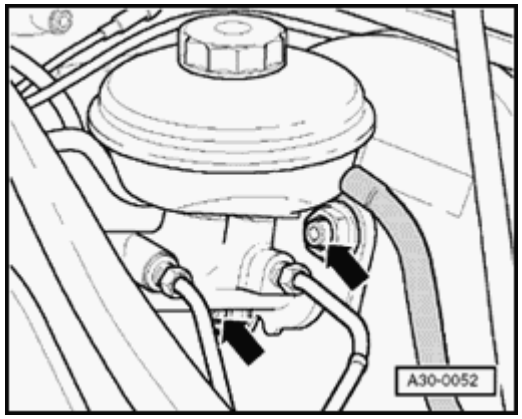
- Unscrew both nuts -A-.
- Lift E-box off studs at the rear and then pull it out of securing point -B-.

Note:

- *In the following procedures, make sure that no brake fluid escapes into the plenum chamber or onto the transmission below. If this does happen, clean the affected areas thoroughly.*
- *When performing work in the footwell, put cloths on the carpet to protect it from possible brake fluid spills.*

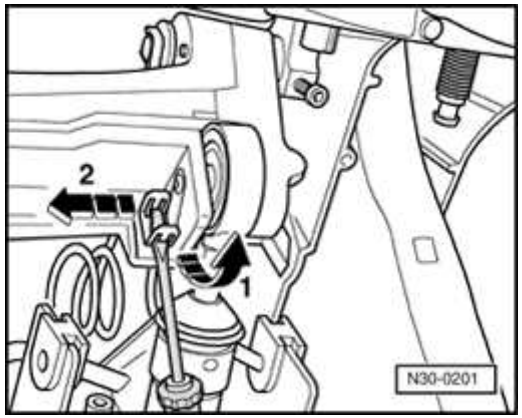


- Clamp supply hose -A- from brake fluid reservoir using special tool 3094. Pull hose off master cylinder and plug hose.
- Remove rubber grommet for compensation hose above connecting line from transverse wall.
- Pry out retaining clip -C- using a screwdriver and pull line -B- out slightly.

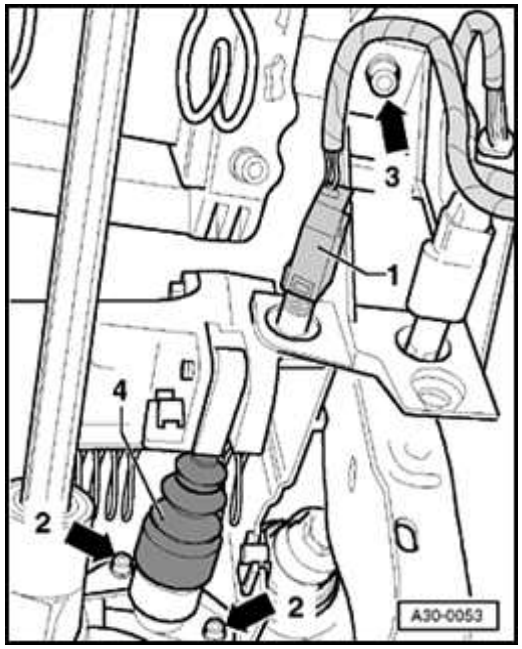


- Remove both socket head bolts (arrows).
- Remove driver's side storage compartment:

⇒ *Repair Manual, Body Interior, Repair Group 68*



- Remove clutch pedal from master cylinder. To do this, pry out bolt lock using screwdriver (arrow -1-), remove bolt (arrow -2-) and depress clutch pedal.



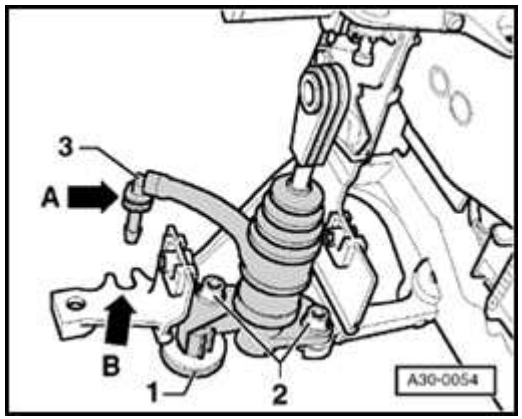
Note:

- *For the following procedures, make sure that the clutch pedal does not press out switch -1- from securing clip, since the thread of the switch would be damaged and the switch would have to be replaced.*
- *To ensure proper securing, the switch may only be installed once.*

- Remove bolts for master cylinder (arrow -2-) and for mounting bracket (arrow -3-).
- Pull complete pedal assembly somewhat toward seating compartment and remove clutch master cylinder -4-.

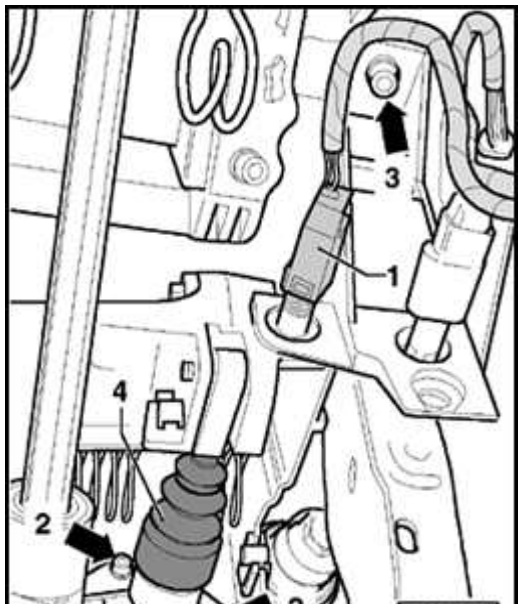
Installing

Installation is the reverse order of removal, while noting the following:

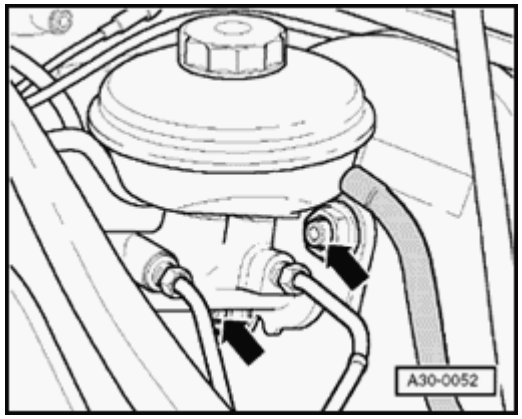


- Insert master cylinder so that the so that seal -1- with washer sits behind bearing mount and tighten bolts -2- to 20 Nm.
- Press connecting line -3- with guide -arrow A- into groove -arrow B- at mounting bracket.

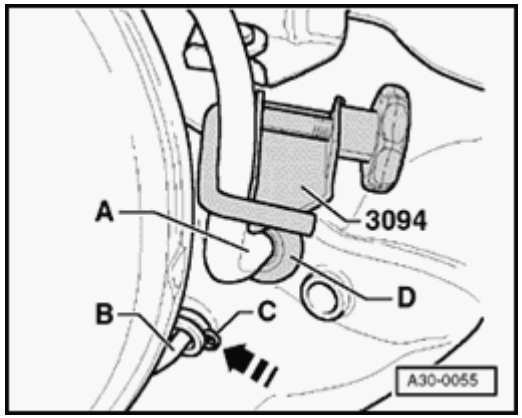
A second technician is necessary for the next work step.



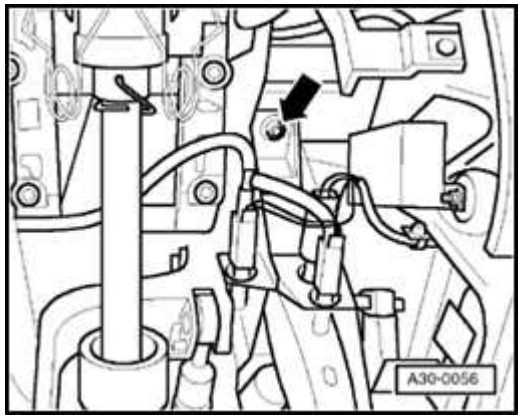
- Slide complete pedal assembly forward, toward transverse wall, insert bolt (arrow -3-) and tighten by hand. At the same time, second technician must insert tube from plenum chamber into master cylinder.



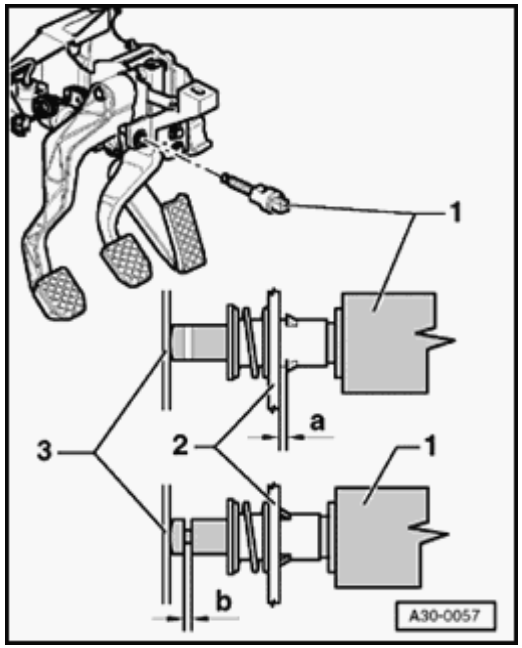
- Tighten bolts for brake booster (arrows) to 25 Nm.



- Press securing clip -C- in to stop.
- Insert tube -B- into master cylinder until the tube engages audibly.
- Insert rubber grommet -D- into transverse wall above connecting tube/after-run hose -A-.
- Slide on after-run hose -A- to brake fluid reservoir to stop.
- Remove special tool 3094.



- Tighten socket head bolt (arrow) for pedal assembly to 25 Nm.
- Connect master cylinder to clutch pedal. Engage bolt lock into clutch pedal.
- Bleed clutch system after installing master cylinder ⇒ Page 30-25 .



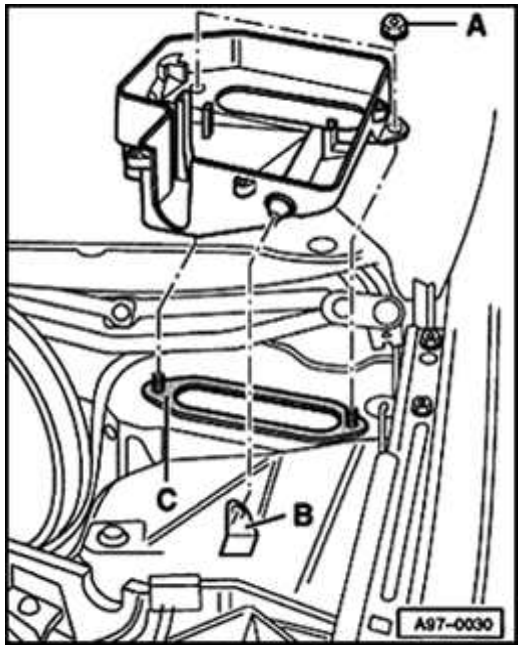
- Check adjustment of switch -1- above clutch pedal as follows:
  - Switch -1- must lie against clutch pedal -3- completely and must be completely activated.
  - Adjustment tolerance: gap measurement -a- between retaining clip and mounting bracket -2- or gap measurement -b- at switch -1- may be a maximum of 0.5 mm.
  - To adjust, hold clip and rotate switch -1-.

Note:

Connect clutch master cylinder with clutch pedal. Engage bolt lock in clutch pedal.

- Remove driver's side storage compartment:

⇒ *Repair Manual, Body Interior, Repair Group 68*



- Always replace seal -C-.
- Make sure seal does not cover chassis opening and elevated edge of sheet metal.
- Insert E-Box in securing point -B- and tighten nuts -A- to 4 Nm.
- Press cover on by hand and tighten bolts -A- diagonally to 4 Nm (also see inscription on cover).
- Install engine wiring harness and connect harness connector in connector station.
- Install engine control module and if necessary, auxiliary relay carrier and auxiliary fuse holder.

⇒ *Repair Manual, Electrical Equipment, Repair Group 97*

Clutch system, bleeding

Special tools, testers and auxiliary items

- Brake filling and bleeding appliance V.A.G 1238 B

or

- Brake filling and bleeding appliance V.A.G 1869

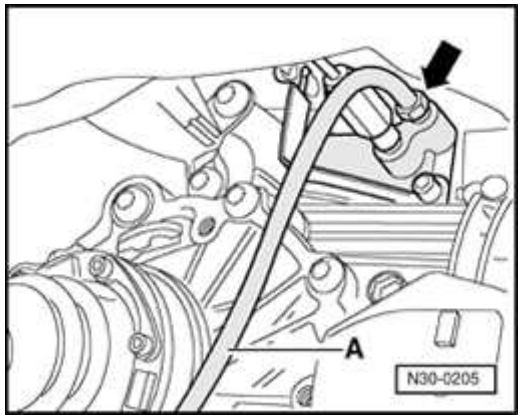
Note:

- *First open bleeder valve before switching on bleeding appliance.*
- *When performing the following steps, make sure that no brake fluid escapes onto the transmission.*
- *The clutch system must be bled after performing work on hydraulic clutch mechanism.*
- *Top-up brake fluid reservoir to "max." marking with brake fluid before bleeding clutch system.*

- Pull clutch pedal back to its normal position.

- Connect brake filling and bleeding appliance V.A.G 1238 B or V.A.G 1869, but do not switch on at this stage.

30-26



- Connect bleed hose -A- to slave cylinder (arrow) and open bleed valve.
- Connect bleeder hose to pressure hose of fluid collector bottle.
- Switch on bleeder appliance and allow about 100 cm3 of brake fluid to drain out.

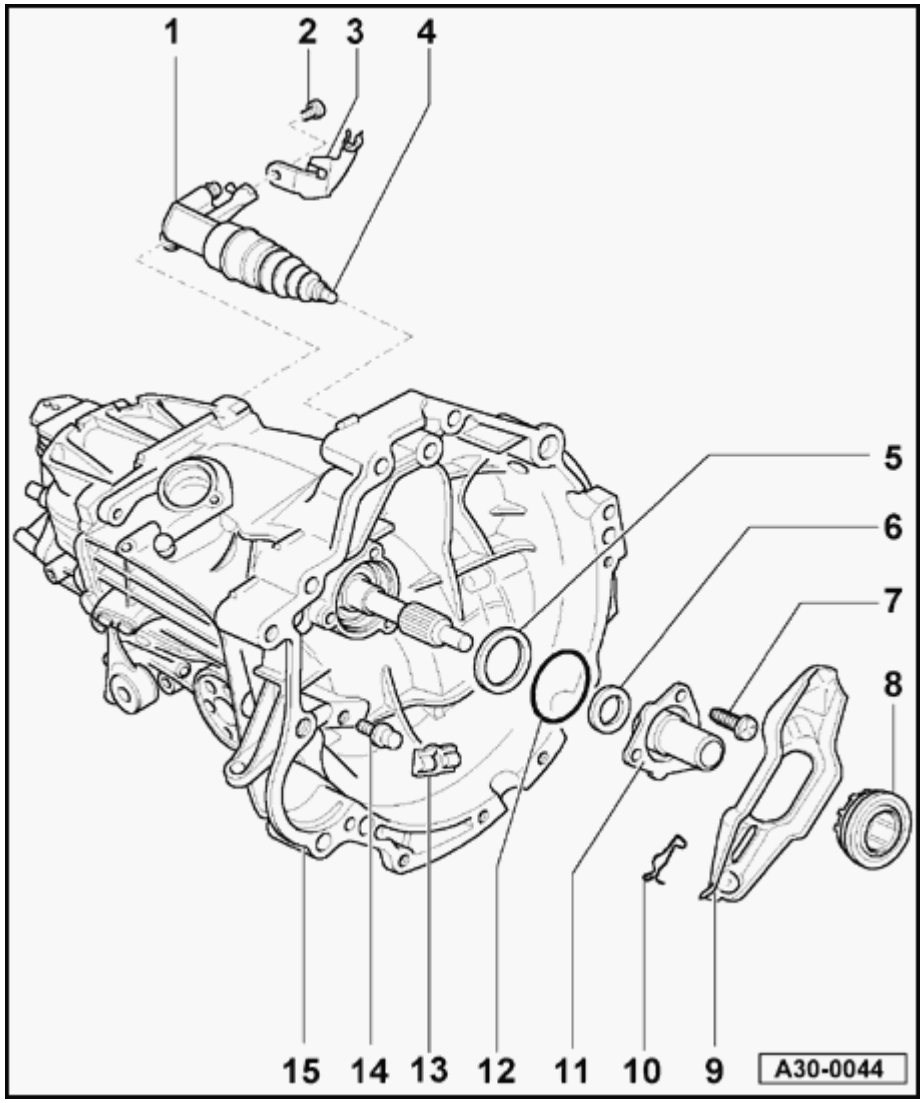
  Working pressure: 2.5 bar

Note:

Ensure bleeder hose is correctly fitted during bleeding operation.

- Close bleeder valve and tighten to 4.5 Nm.
- Depress clutch pedal several times after completion of bleeding process.
- Bleed system again if necessary.

30-17



Clutch release mechanism, servicing

1 - Clutch slave cylinder

- Do not press clutch pedal after clutch slave cylinder has been removed
- Installing ⇒ Fig. 1
- Tension clutch slave cylinder enough so that mounting bolts can be easily installed

2 - Bolt

Hex bolt:

- Before installing, coat with D 185 400 A2 locking fluid
- Tightening torque: 25 Nm (18 ft lb)

Socket-head bolt:

- Always replace
- Self-locking
- Tightening torque: 20 Nm (15 ft lb)

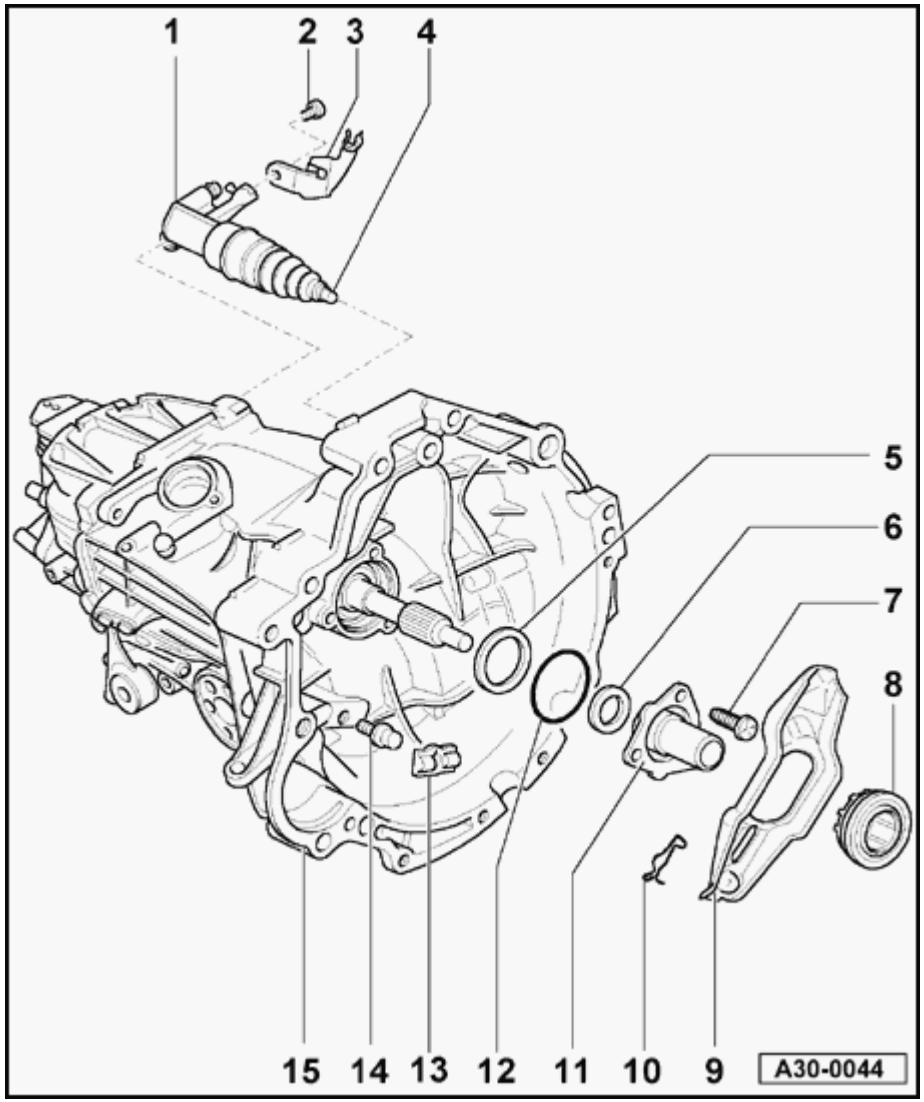
3 - Bracket for hose/line assembly

- Attach to clutch slave cylinder
- Not always present

4 - Plunger

- Lubricate end of plunger with copper grease, e.g. 381 351 TE

30-18



5 - Spring washer

- Small diameter facing guide sleeve (convex side)

6 - Input shaft seal

- Use VW681 extractor lever to remove from guide sleeve
- Use VW192 arbor to drive in to stop

7 - Torx® bolt

- Always replace
- 35 Nm (26 ft lb)
- Self-locking

8 - Throwout bearing

- Do not rinse out bearing, wipe clean only
- Replace noisy bearings

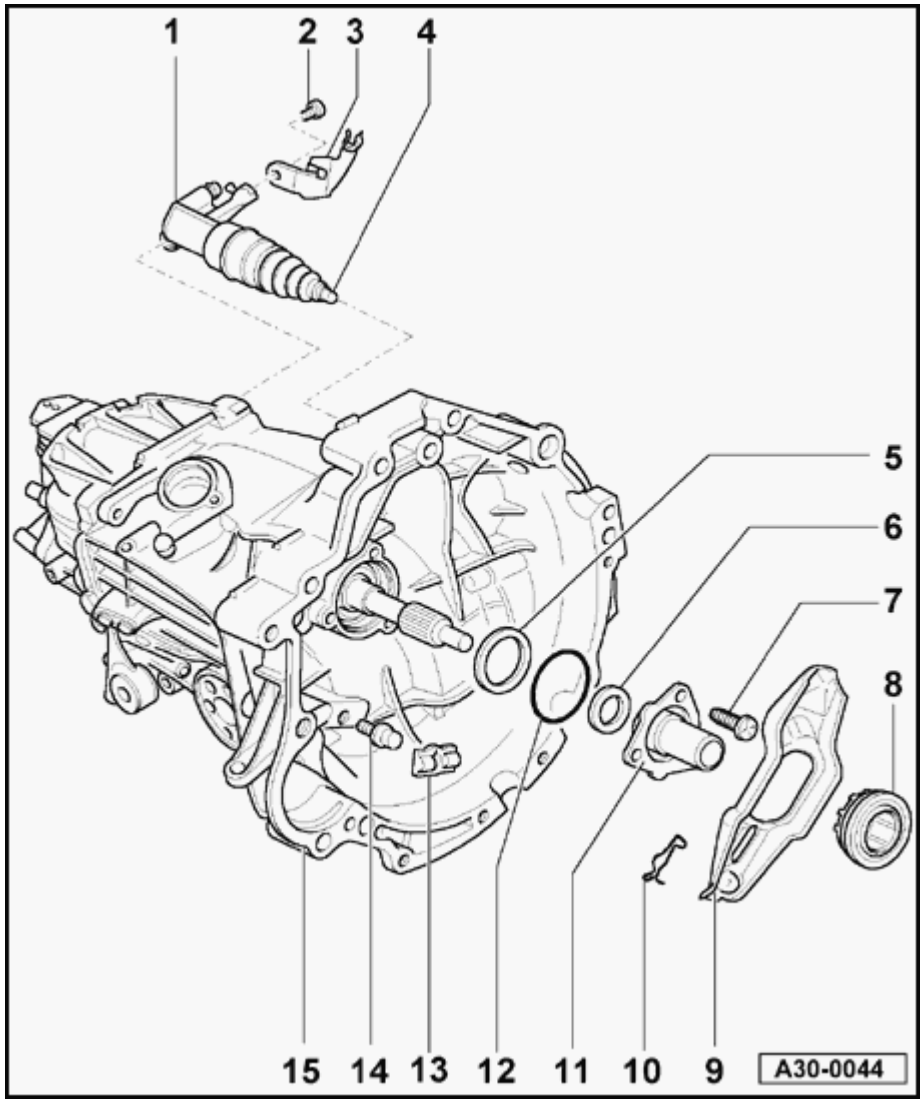
9 - Clutch release lever

- Before installing, coat contact surface of clutch slave cylinder plunger with layer of copper grease, e.g. Z 381 351 TE

10 - Retaining spring

- Secure to clutch release lever

30-19



11 - Guide sleeve

- Before removing and installing, cover input shaft splines with shrink-tube to protect seal

12 - O-ring

- Always replace

13 - Intermediate piece

14 - Ball pivot pin

- 25 Nm (18 ft lb)
- Lubricate with MoS2 grease

15 - Transmission

30-20

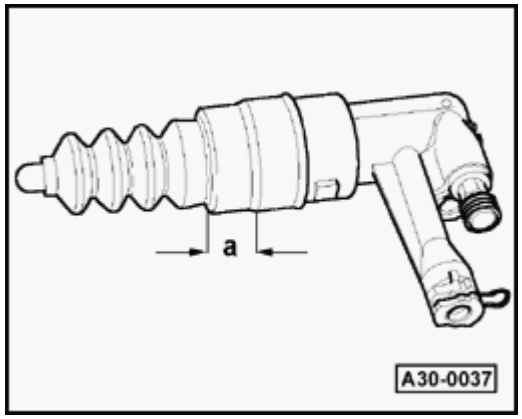
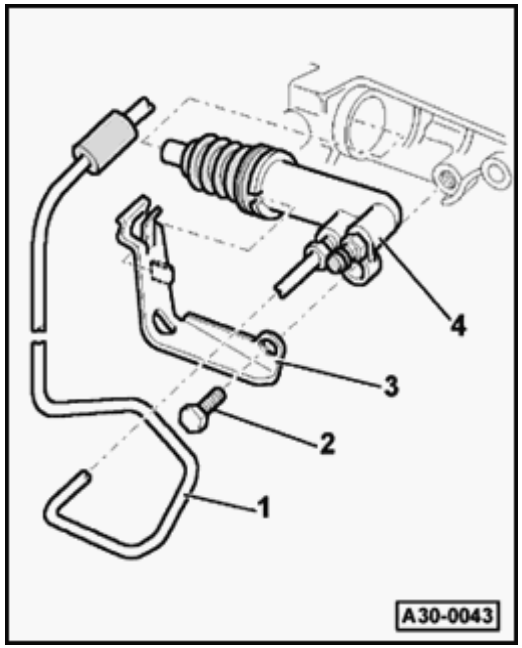


Fig. 1 Installing clutch slave cylinder

- Before installing, coat contact surface of clutch release lever plunger with thin layer of copper grease, e.g. Z 381 351 TE.
- Before installing clutch slave cylinder in transmission, coat boot area -a- with G 052 150 A2 lithium grease.
- Guide clutch slave cylinder into bore of transmission housing without large sideways deviation from direction of motion of plunger.



- Attach bracket -3- for pressure line -1-.

Notes:

- *If clutch slave cylinder -4- is inserted crooked, there is a possibility that the plunger will be inserted past the clutch release lever.*
- *Pre-load the clutch slave cylinder enough so that the mounting bolt can be easily installed.*

- Install mounting bolt -2-.
- Install hex bolt with D 185 400 A2 locking fluid and tighten to 25 Nm (18 ft lb).

  If socket-head bolt is used, it is self-locking: always replace and tighten to 20 Nm (15 ft lb).

30-21

Clutch, servicing

Special tools and equipment

- 3067 flywheel retainer
- 3176 centering mandrel

Notes:

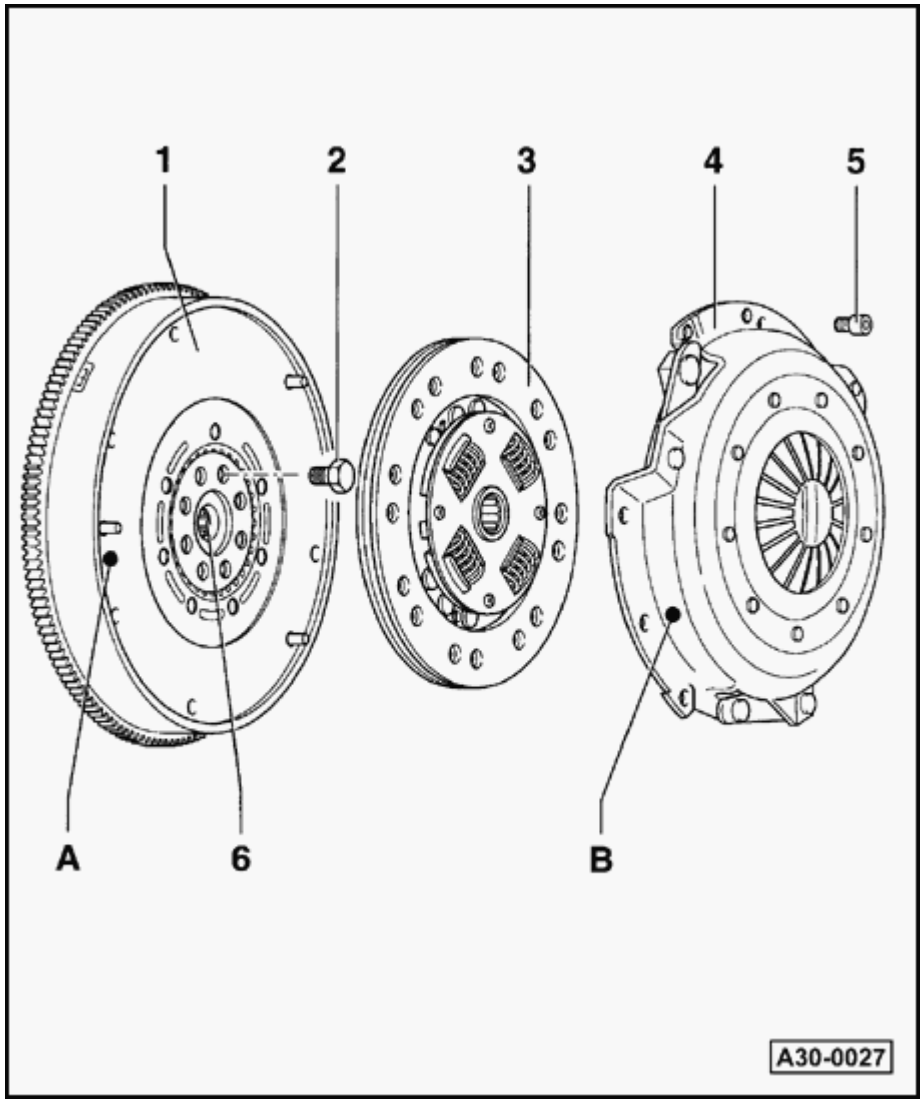
- *Observe general repair instructions ⇒ Page 00-10 .*
- *Replace clutch plates and pressure plates which have damaged or loose rivets.*
- *Select the correct clutch plate and pressure plate according to the engine code ⇒ parts catalog.*
- *Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 to the splines. Then move clutch plate back and forth on input shaft until hub moves freely on shaft. Excess grease must be removed.*

  Pressure plates have an anti-corrosion coating

- *and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.*

- *If the clutch has been burned out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission to reduce the smell of burnt clutch.*

30-22



- Remove transmission to work on clutch ⇒ Page 34-18 .

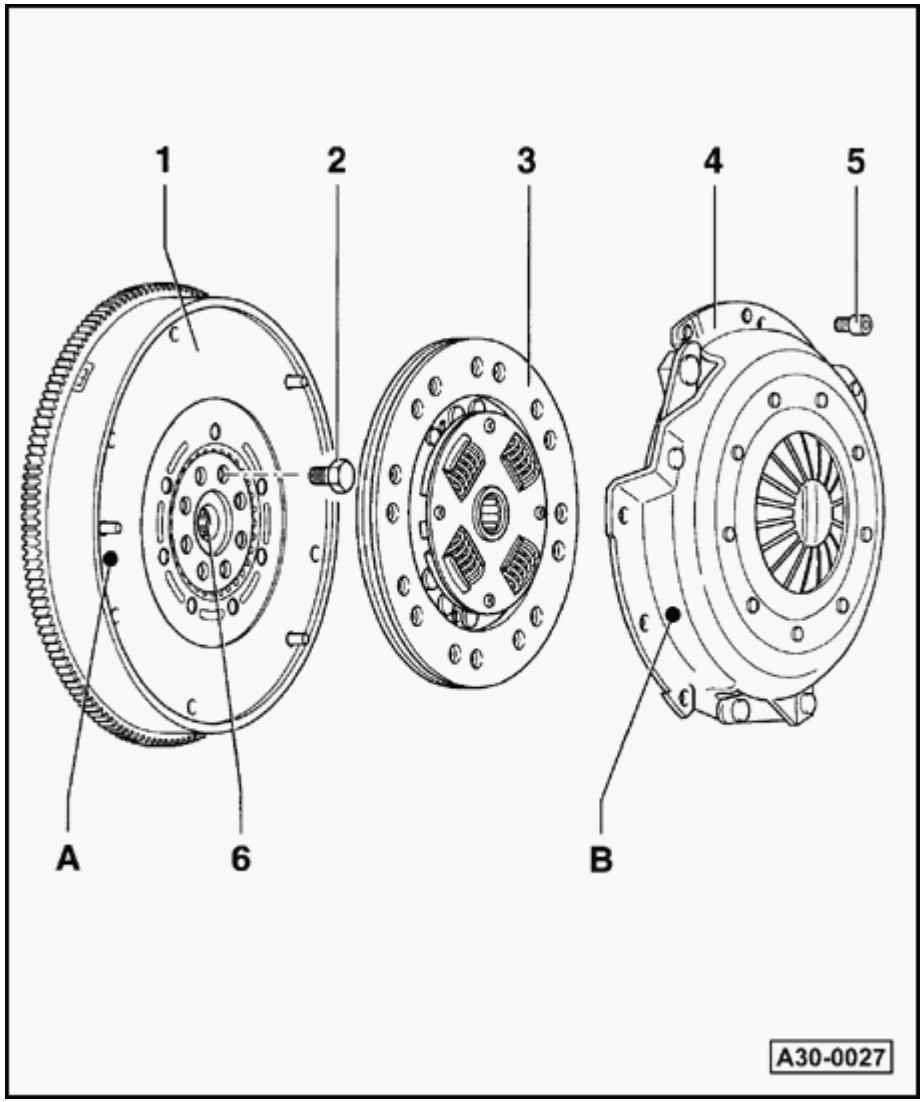
A - Color marking on dual-mass flywheel

- White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate (if present)

B - Color marking on pressure plate

- White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate (if present)

30-23



1 - Dual-mass flywheel

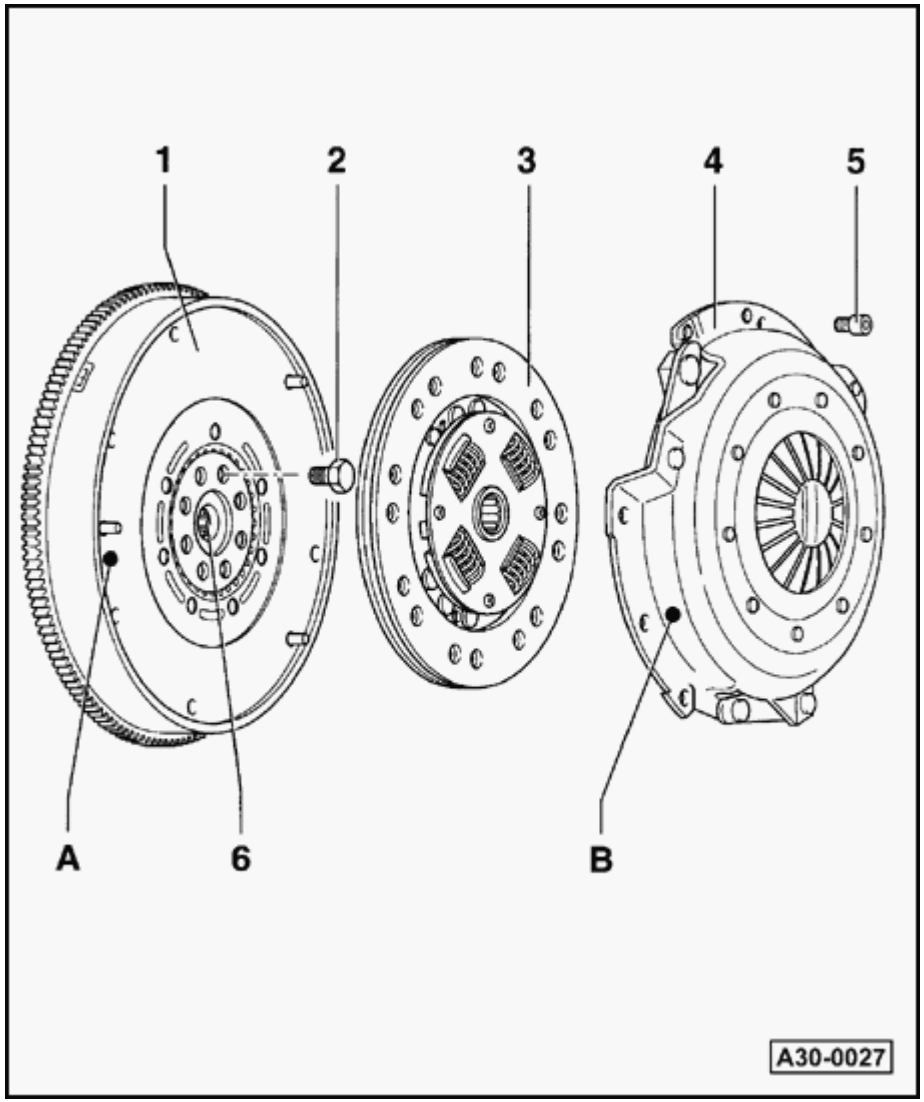
- Make sure centering pins are in place and seated correctly
- Contact surface for clutch lining must be free of dirt, oil and grease
- Removing and installing:

⇒ *Repair Manual, Engine Mechanical, Repair Group 13*

2 - Bolt

- Always replace
- With dual-mass flywheel: 60 Nm (44 ft lb) + 1/2 turn (180°)
- Without dual-mass flywheel: 60 Nm (44 ft lb) + 1/4-turn (90°)

30-24



3 - Clutch plate

- Installation position: Spring pack (coil springs) facing pressure plate. Clutch lining must make full contact with flywheel. Marking "Getriebeseite" (if provided) faces pressure plate
- Do not lubricate
- Clutch plate diameter ⇒ Page 00-3
- Centering ⇒ Fig. 1
- Lightly lubricate splines

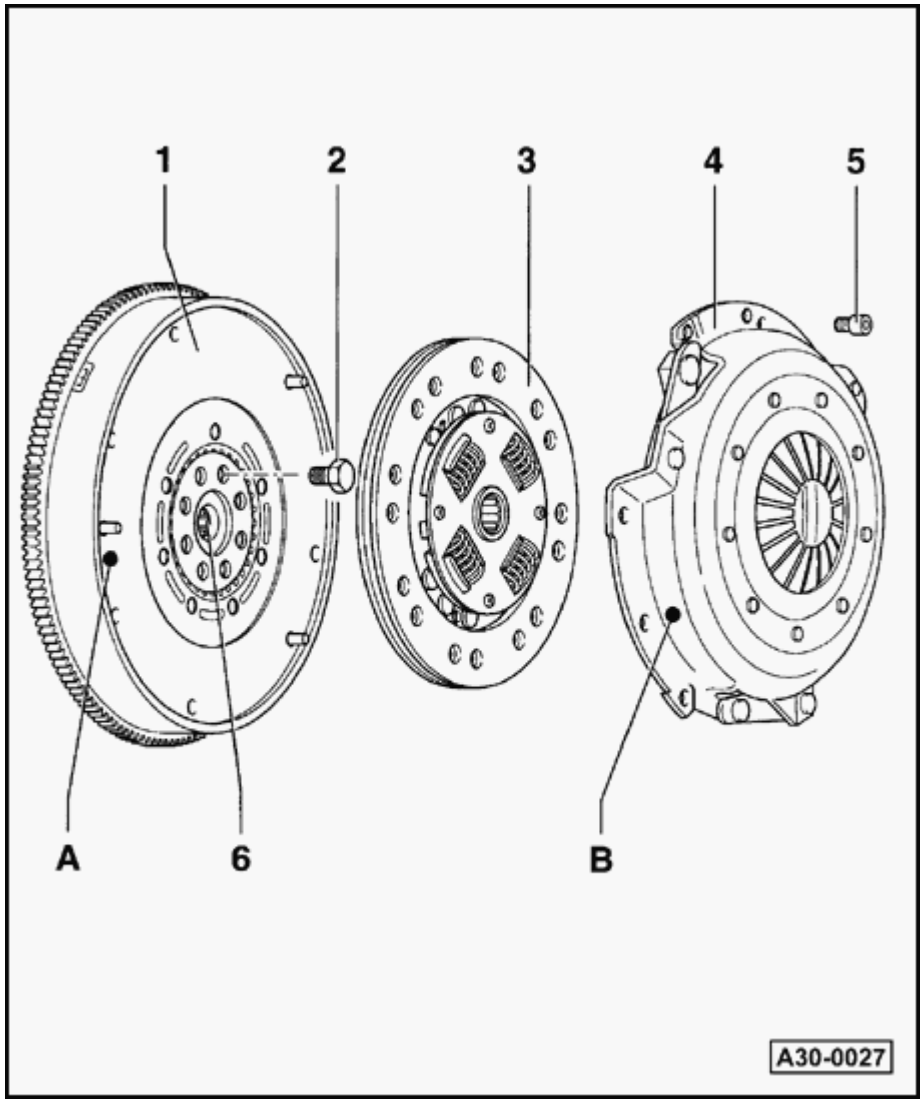
4 - Pressure plate

- Removing and installing ⇒ Fig. 1
- Checking ends of diaphragm spring ⇒ Fig. 2
- Checking spring connection and rivets ⇒ Fig. 3

5 - Bolt

- 25 Nm (18 ft lb)
- Loosen and tighten in stages and in diagonal sequence

30-25



6 - Needle roller bearing

- Removing and installing

⇒ *Repair Manual, Engine Mechanical, Repair Group 13*

30-26

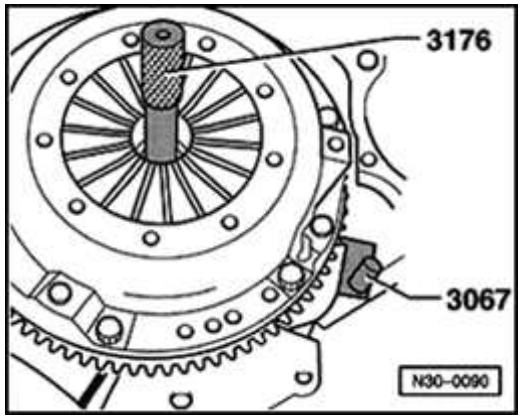


Fig. 1 Centering clutch plate and removing and installing pressure plate

Special tools and equipment

- 3067 flywheel retainer
- 3176 centering mandrel

Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" facing pressure plate and transmission.

- When installing on 2.8 Liter 5V 142 kW engine (or 2.8 Liter 128 kW engine if installed), make sure white color marking on dual-mass flywheel lines up with white color marking on pressure plate when assembling.

Clutch lining and contact surface of pressure plate must make full contact with flywheel before bolts are inserted.

- Loosen and tighten bolts in stages and in diagonal sequence.

  Final tightening torque: 22 Nm (16 ft lb).

- Reverse position of 3067 flywheel retainer when removing.
- Use 3176 centering mandrel to center clutch plate.

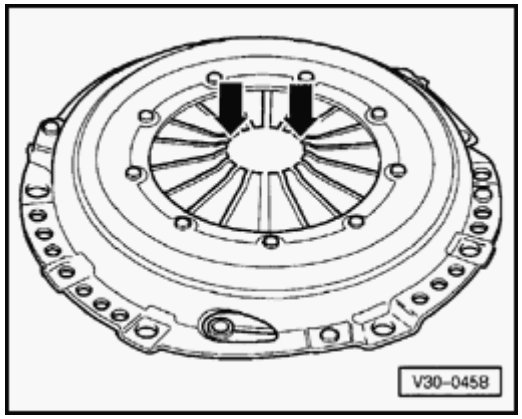


Fig. 2 Checking ends of the diaphragm spring

Wear up to half the thickness of the diaphragm spring is permitted.

Note:

For repairs, it is essential to match the clutch pressure plate and the clutch disc according to the engine code letters using the parts catalog microfiche.

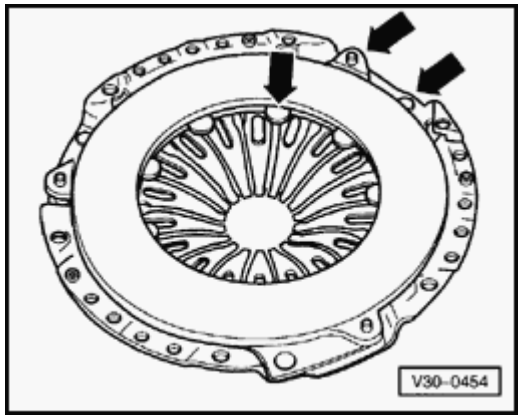
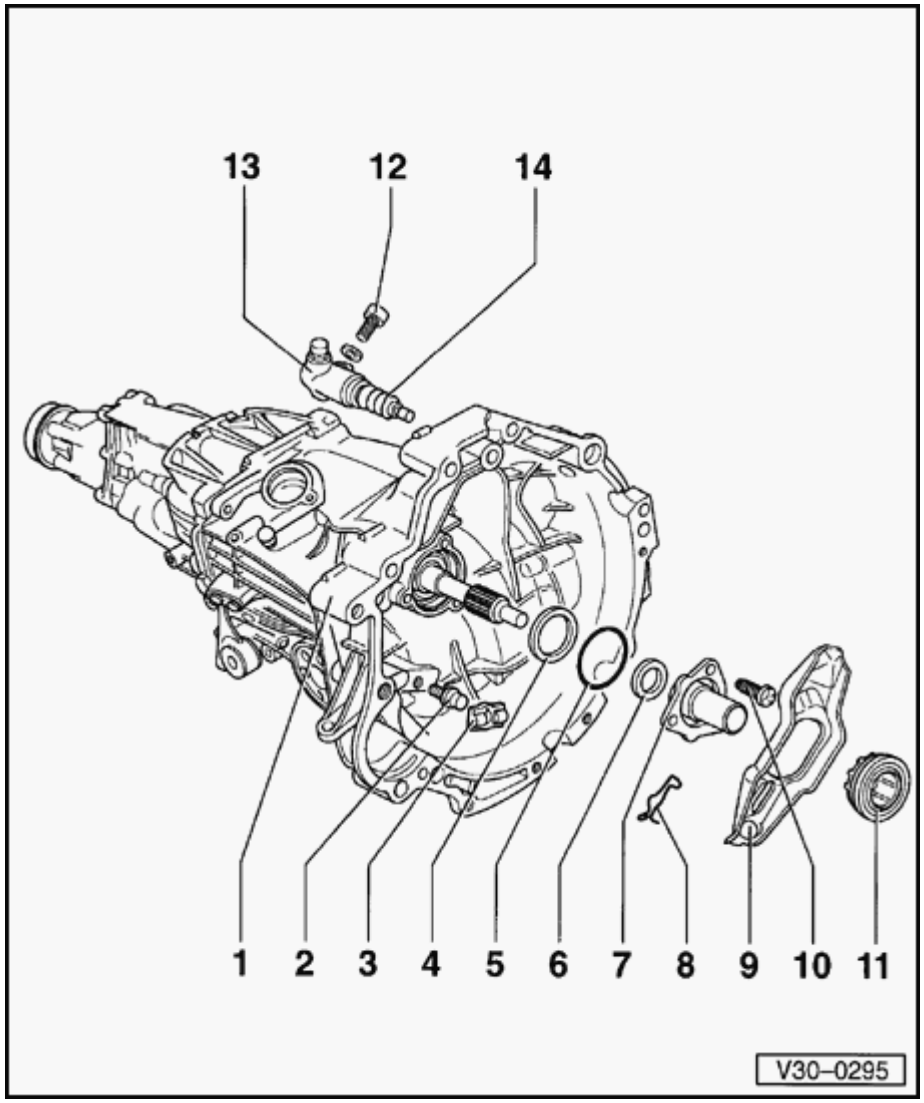


Fig. 3 Checking spring connection and rivets

- Check spring connection between pressure plate and cover for cracks and make sure rivets are seated tightly.
- Replace clutches with damaged springs or loose rivets (arrows).

30-20



Clutch release mechanism, servicing

1 - Transmission

2 - Ball pivot pin

- 25 Nm (18 ft lb)
- Lubricate with MoS2 grease

3 - Intermediate piece

4 - Dished washer

- Smaller diameter (rounded side) faces guide sleeve

5 - O-ring

- Always replace

6 - Seal for input shaft

- Pull out of guide sleeve using VW681 extractor lever
- Drive in onto stop using VW192 fitting sleeve

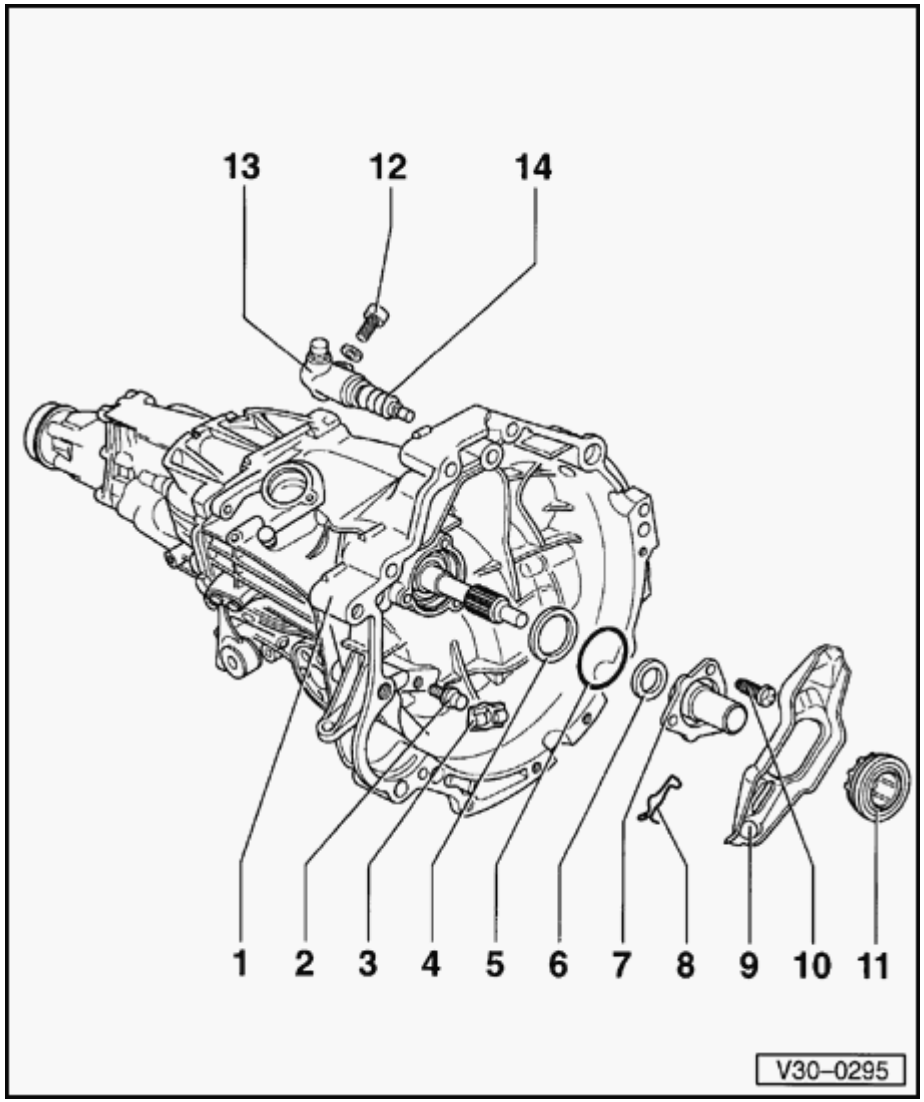
7 - Guide sleeve

- Before removing and installing, cover input shaft splines with shrink-tube to protect seal

8 - Retaining spring

- Secure to clutch release lever

30-21



9 - Clutch release lever

- Before installing, coat contact surface of clutch slave cylinder plunger with thin layer of copper grease, e.g. 381 351 TE

10 - Torx® bolt

- Always replace
- 35 Nm (26 ft lb)
- Self-locking

11 - Release bearing

- Do not wash-out bearing, wipe clean only
- Replace noisy bearings

12 - Bolt

➢ 8DVA 000 504 socket-head bolt

- 25 Nm (18 ft lb)

8DVA 000 505 ➢ socket-head bolt

- 20 Nm (15 ft lb)

13 - Clutch slave cylinder

- Tension clutch slave cylinder enough, so that mounting bolts can be easily installed.
- Do not operate after clutch pedal has been removed

14 - Plunger

- Lubricate end of plunger with copper grease, e.g. 381 351 TE

30-22

Clutch, servicing

Special tools and equipment

- 3067 flywheel retainer
- 3176 centering mandrel

Notes:

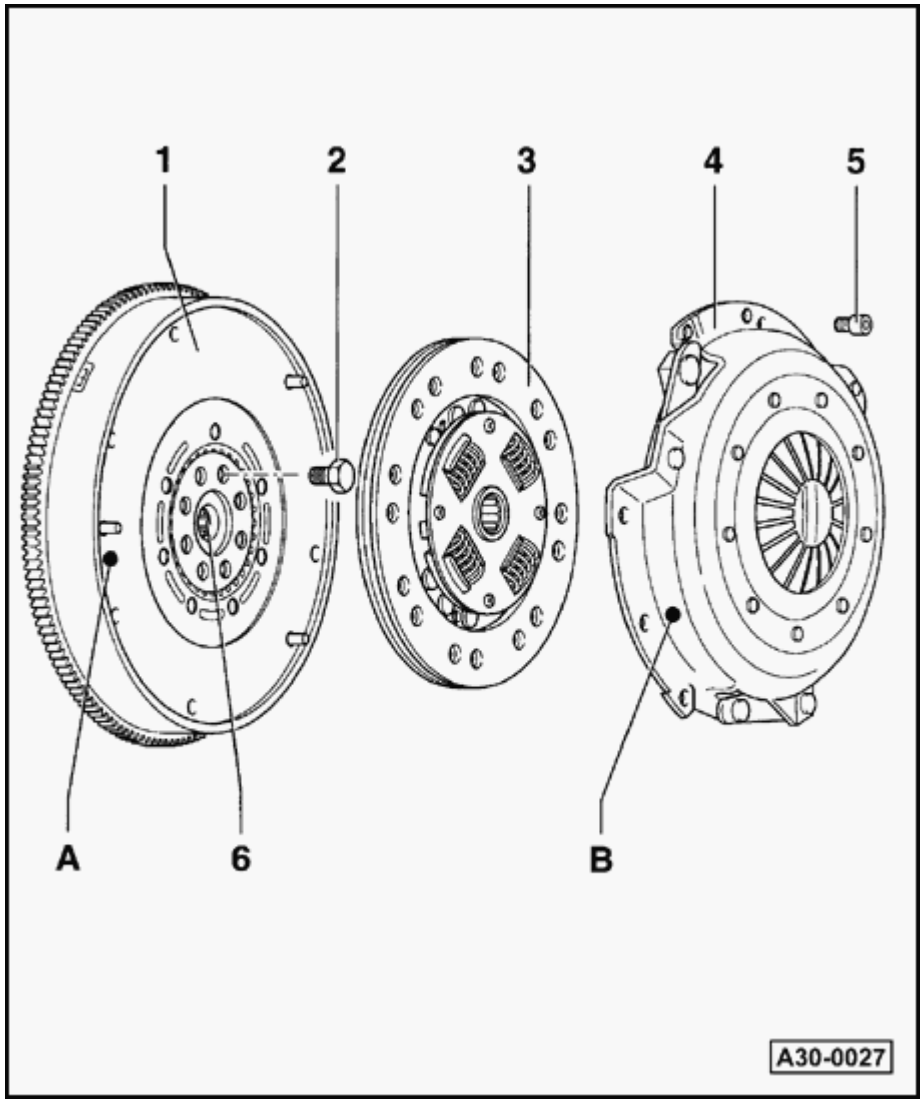
- *Observe general repair instructions ⇒ Page 00-14 .*
- *Replace clutch plates and pressure plates which have damaged or loose rivets.*
- *Select the correct clutch plate and pressure plate according to the engine code ⇒ Parts catalog*
- *Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 to the splines. Then move clutch plate back and forth on input shaft until hub moves freely on shaft. Excess grease must be removed.*

  Pressure plates have an anti-corrosion coating

- *and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.*

- *If the clutch has been burned out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission to reduce the smell of burnt clutch.*

30-23



- Remove transmission to work on clutch ⇒ Page 34-18 .

CAUTION!

Clutch plates or pressure plates with loose or damaged rivets must be replaced.

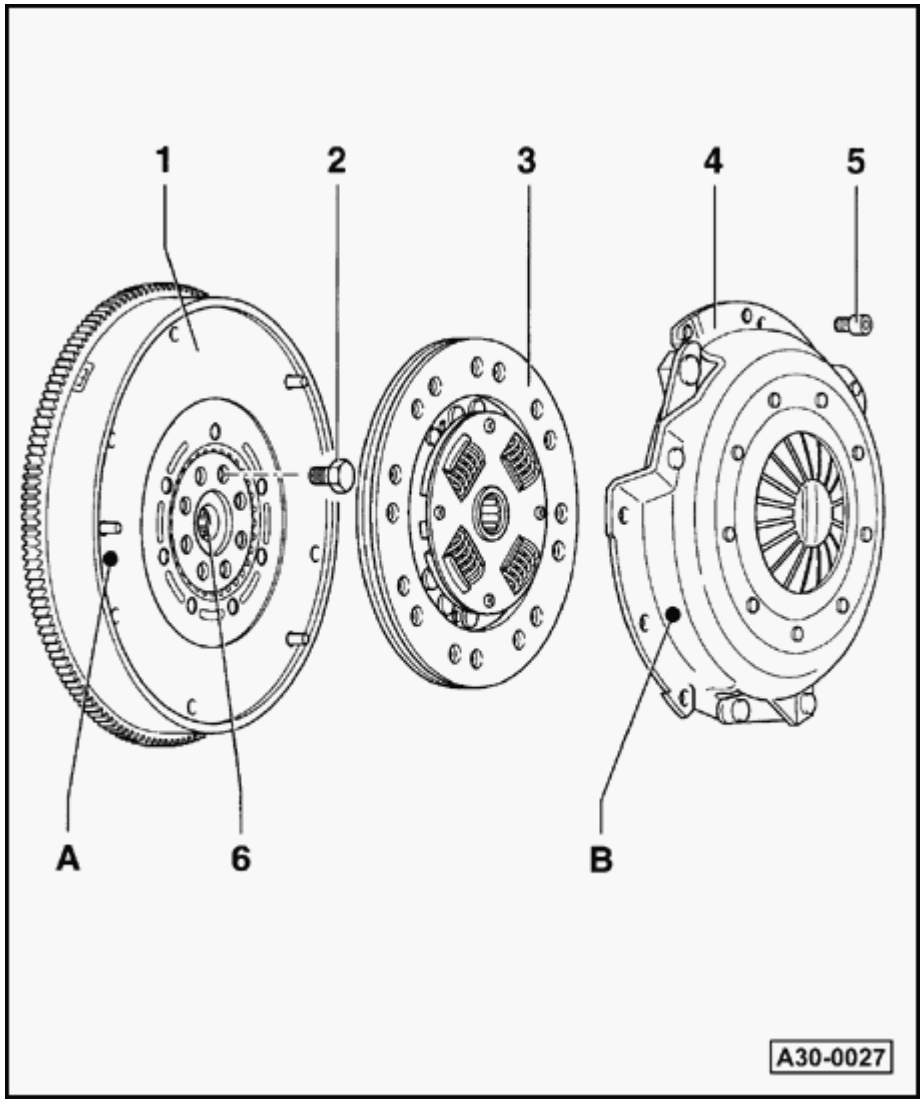
A - Color marking on dual-mass flywheel

- White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate

B - Color marking on pressure plate

- White color marking -A- on dual-mass flywheel must line up with white color marking -B- on pressure plate

30-24



1 - Dual-mass flywheel

- Make sure centering pins are in place and seated correctly
- Contact surface for clutch lining must be free of dirt, oil and grease

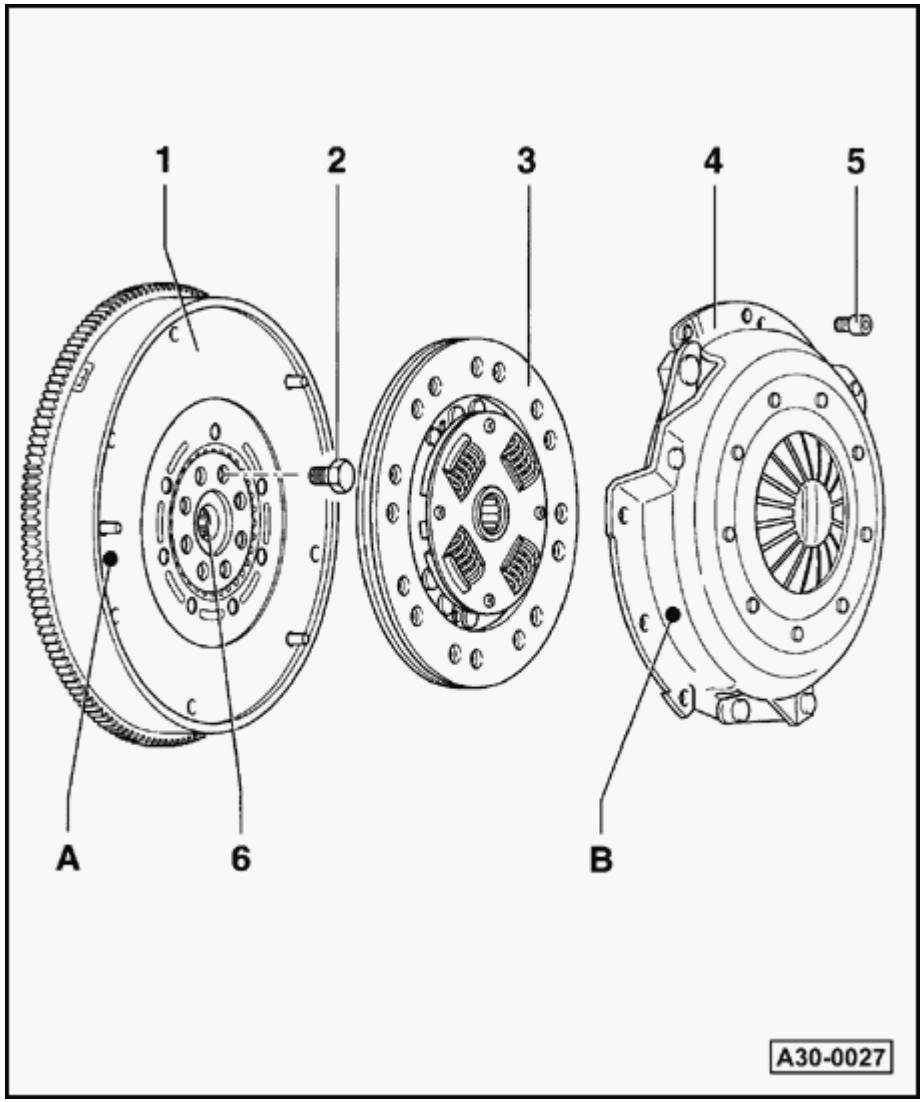
Removing and installing

⇒ Repair Manual, Engine Mechanical, Repair Group 13

2 - Bolt

- Always replace
- With dual-mass flywheel: 60 Nm (44 ft lb) + 1/2 turn (180°)
- Without dual-mass flywheel: 60 Nm (44 ft lb) + 1/4-turn (90°)

30-25



3 - Clutch plate

- Installation position: Spring pack (coil springs) facing pressure plate. Clutch lining must make full contact with flywheel. Marking "Getriebeseite" (if provided) faces pressure plate
- Do not lubricate
- Clutch plate diameter ⇒ Page 00-3
- Centering ⇒ Fig. 1
- Lightly lubricate splines

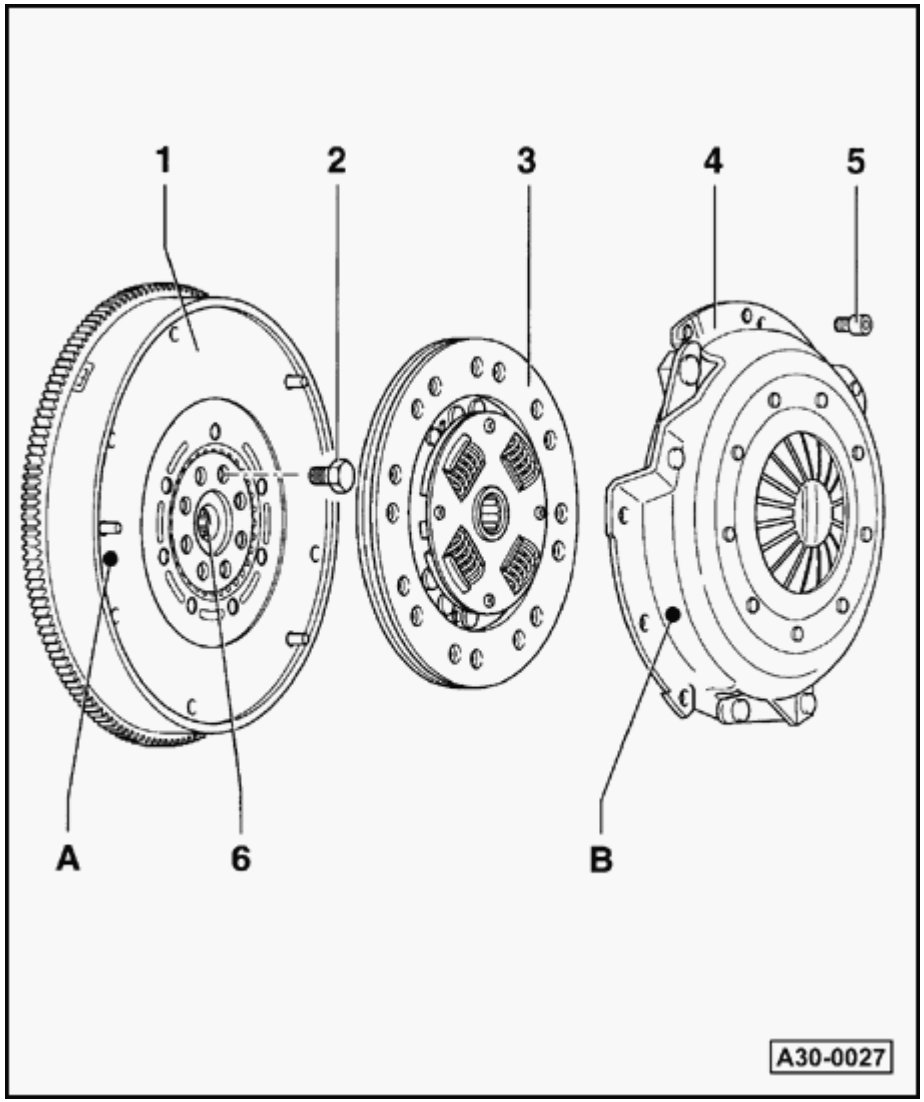
4 - Pressure plate

- Removing and installing ⇒ Fig. 1
- Checking ends of diaphragm spring
- Checking spring connection and rivets ⇒ Fig. 3

CAUTION!

The pressure plate is treated against corrosion and greased. Only the friction surface should be cleaned, otherwise the service life of the clutch will be considerably reduced.

30-26



5 - Bolt

- 25 Nm (18 ft lb)
- Loosen and tighten in stages and in diagonal sequence

6 - Needle roller bearing

Removing and installing

- Repair Manual, Engine Mechanical, Repair Group 13

30-27

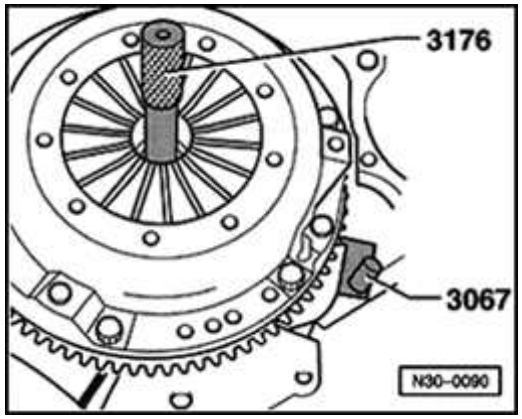


Fig. 1 Centering clutch plate and removing and installing pressure plate

Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" facing pressure plate and transmission.

CAUTION!

- ***Clutch lining and contact surface of pressure plate must make full contact with flywheel before bolts are inserted.***
- ***Tighten bolts evenly and in diagonal sequence to avoid damaging centering holes in the pressure plate and centering pins on the flywheel.***

- Make sure white color marking on dual-mass flywheel lines up with white color marking on pressure plate when assembling.
- Loosen and tighten bolts in stages and in diagonal sequence.

  Final tightening torque: 25 Nm (18 ft lb)
- Reverse position of 3067 flywheel retainer when removing.
- Use 3176 centering mandrel to center clutch plate.

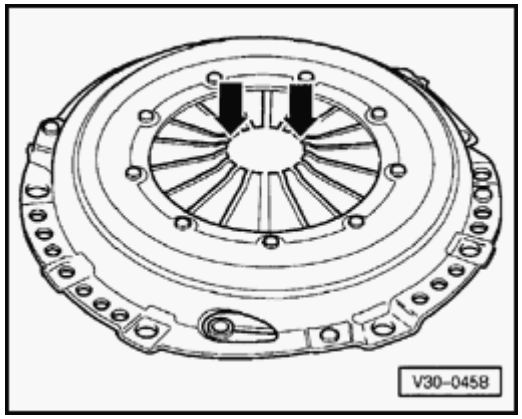


Fig. 2 Checking ends of the diaphragm spring

Wear up to half the thickness of the diaphragm spring is permitted

CAUTION!

For repairs, it is essential to match clutch pressure plate and clutch disc according to engine code letters using the Parts catalog microfiche.

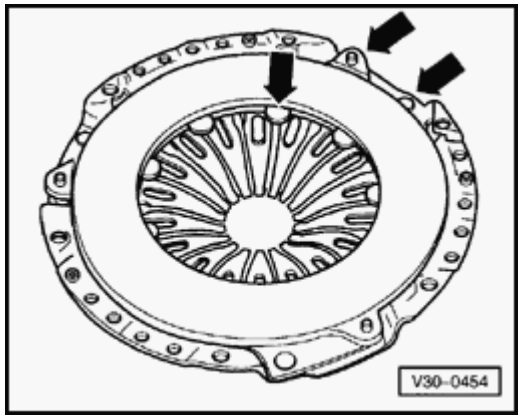
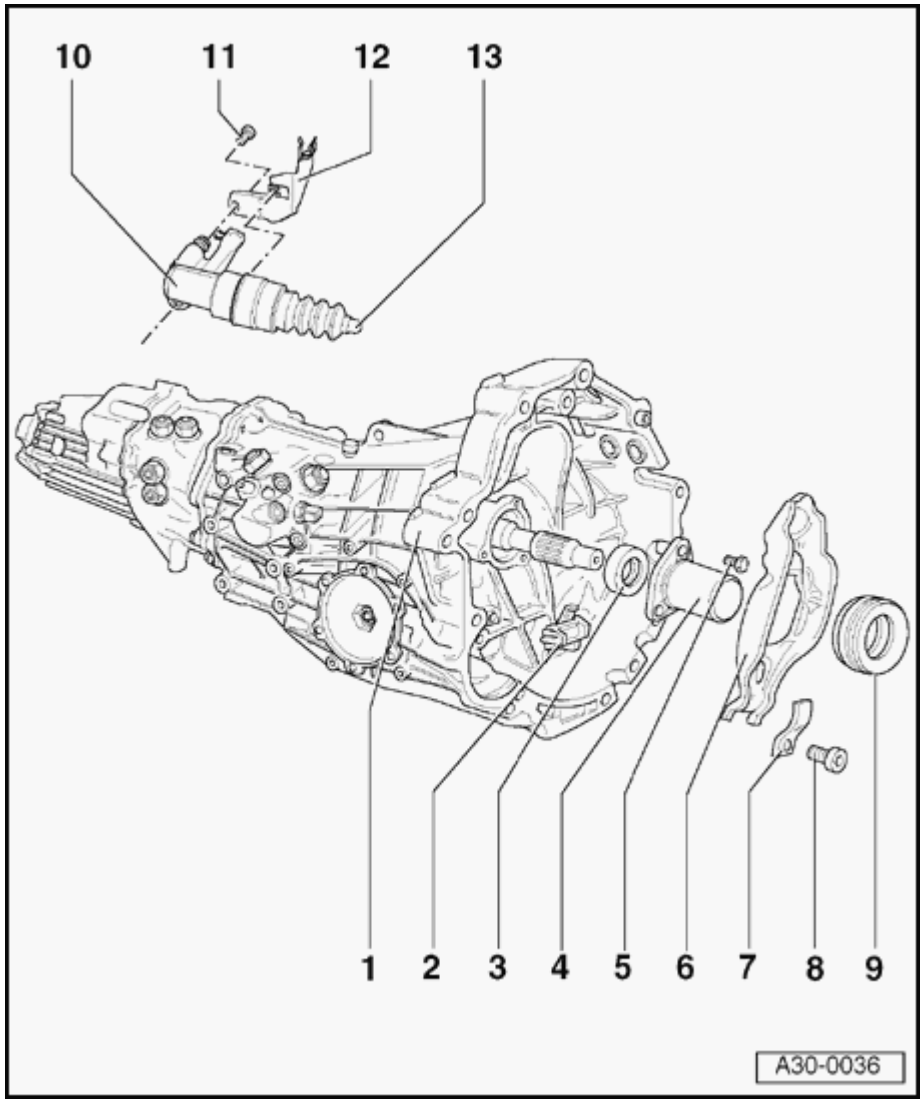


Fig. 3 Checking spring connection and rivets

- Check spring connection between pressure plate and cover for cracks and make sure rivets are seated tightly.
- Replace clutches with damaged springs or loose rivets (arrows).

30-27



Clutch release mechanism, servicing

1 - Transmission

2 - Intermediate piece

- Replace if damaged

3 - Shaft seal

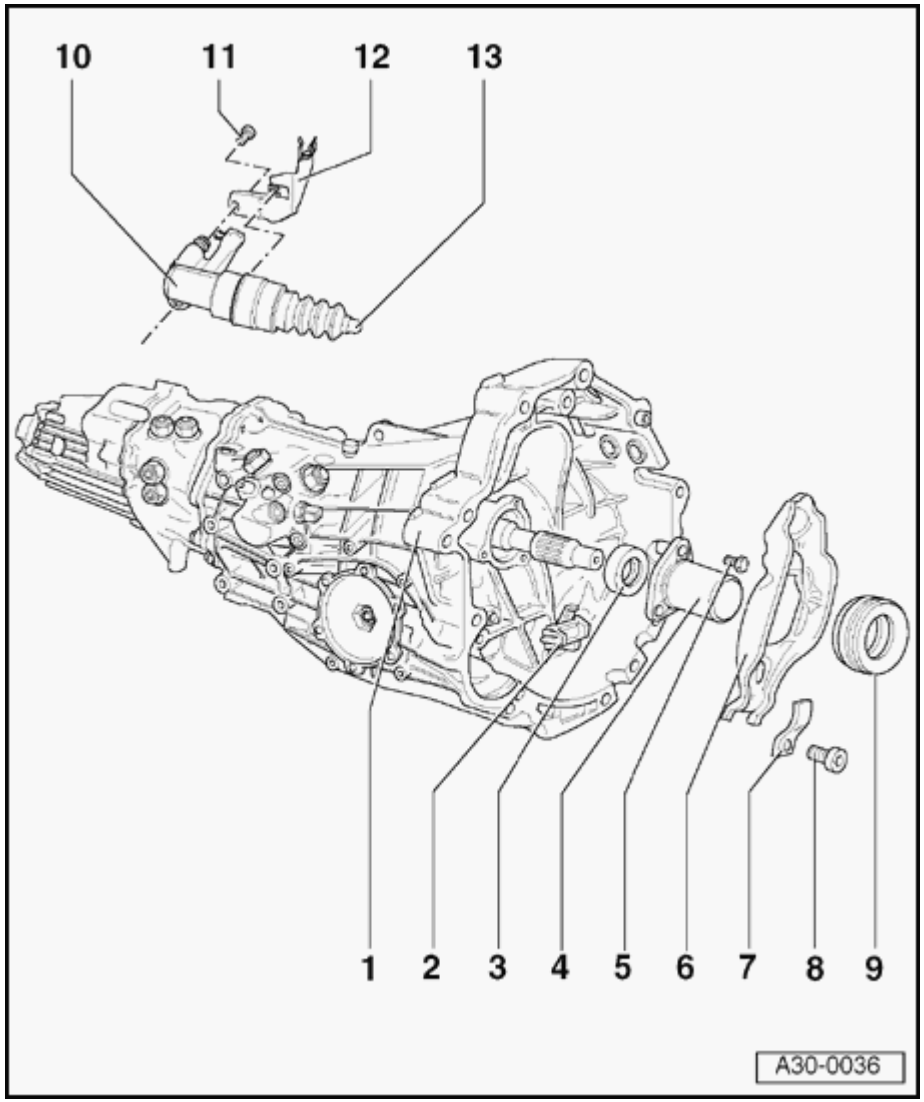
- For input shaft
- Removing ⇒ Fig. 1
- Installing ⇒ Fig. 2
- Pressing-in depth (factory): 3.5 mm
- Pressing-in depth (repairs): 4.5 mm

4 - Guide sleeve

5 - Bolt, 15 Nm

- Qty. 3

30-28



6 - Clutch release lever

- Removing ⇒ Fig. 3
- Must engage in the lugs in intermediate piece when installed ⇒ Fig. 4
- Before installing, coat contact surface of clutch slave cylinder push rod with a thin layer of copper grease, e.g. Z381 351 TE

7 - Leaf spring

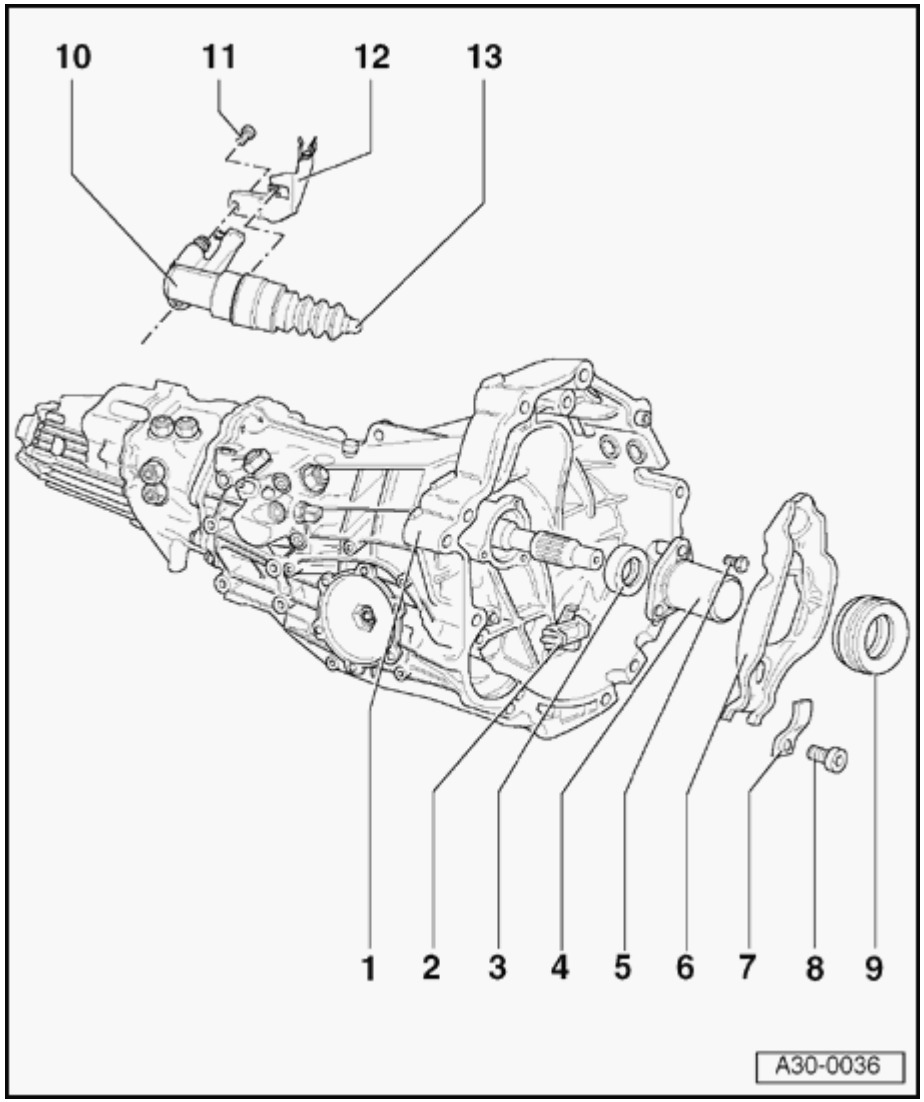
8 - Bolt, 25 Nm

- Self-locking
- Always replace

9 - Release bearing

- Do not wash out, wipe clean only
- Replace noisy bearings
- Retainer lugs on release bearing must engage in release lever

30-29



10 - Clutch slave cylinder

- Bleeding clutch system ⇒ Page 30-25
- Removing and installing ⇒ Page 30-32
- When installing, push on until the securing bolt can be fitted

11 - Bolt, 20 Nm

- Self-locking
- Always replace

12 - Bracket for hose/line assembly

- Engage in clutch slave cylinder

13 - Push rod

- Coat contact surface of push rod with copper grease, e.g. Z 381 351 TE

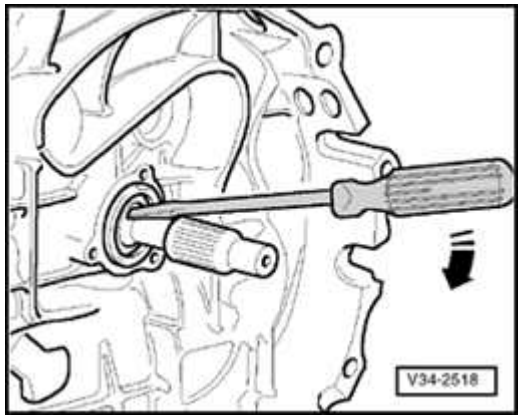


Fig. 1 Removing shaft seal for input shaft

- pry seal out carefully with a screwdriver.

Note:

Do not damage contact surface of shaft seal on input shaft.

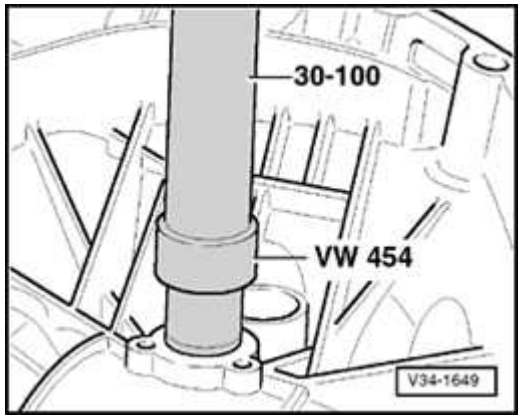


Fig. 2 Installing shaft seal for input shaft

- Pack space between sealing lip and dust lip of new seal for input shaft with multi-purpose grease.
- Fit a thin protective hose tightly over input shaft splines.
- Drive on seal for input shaft.
  - Pressing-in depth when fitted at factory: 3.5 mm
  - Pressing-in depth after repair work: 4.5 mm
- Remove protective hose.

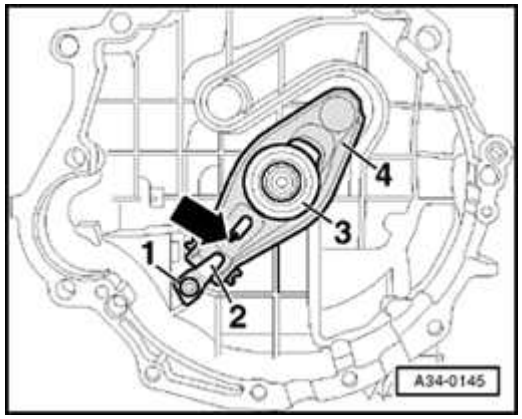


Fig. 3 Removing clutch release lever

- Loosen bolt -1-, remove leaf spring -2- and press back detent (arrow).
- Remove clutch release lever -4- together with release bearing -3-.
- Disengage release bearing retainer lugs from release lever.

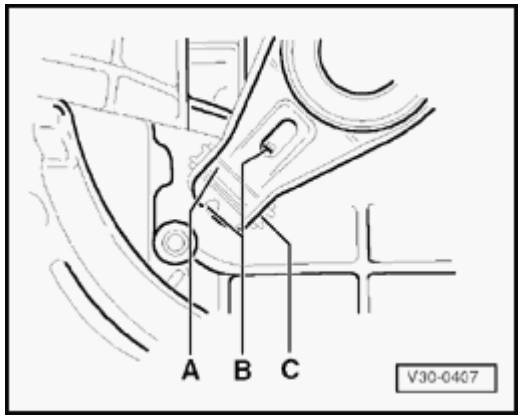


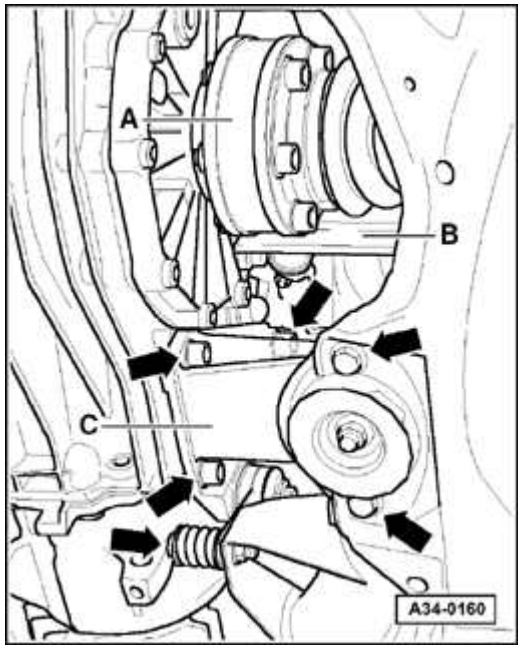
Fig. 4 Installing clutch release lever

- Before installing clutch release lever, coat contact surface for slave cylinder push rod with with a thin layer of copper paste.
- Insert clutch release lever -A- into intermediate piece -C- and engage (detent -B- will come into view).
- Insert leaf spring (-item 7 -, Page ⇒ Page 30-28) and tighten retaining bolt (-item 8 -, Page ⇒ Page 30-28) to 25 Nm.

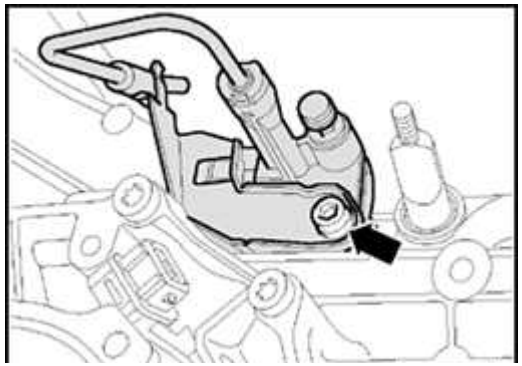
30-32

Clutch slave cylinder, removing and installing

Removing



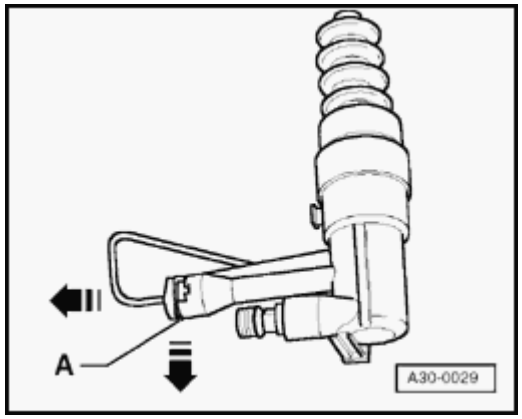
- Unbolt left drive axle -A- from transmission and move clear to one side.
- Remove heat shield -B- from transmission.
- Unscrew bolts (arrows) and remove left transmission support -C- together with transmission mounting.



- Remove bolt (arrow) and take out slave cylinder from the rear.

Note:

Do not depress clutch pedal after removing slave cylinder.



- To disconnect line, first pry out retaining clip -A- with a screwdriver until it disengages audibly. Line can then be pulled out.

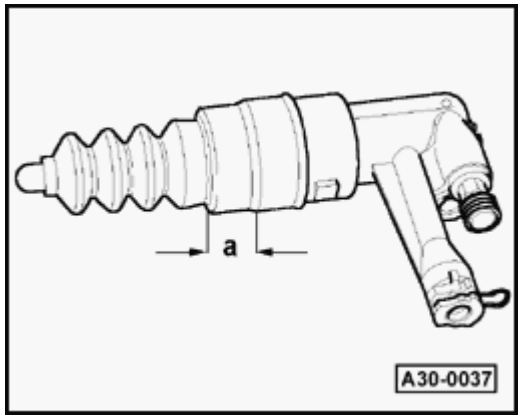
Installing

Installation is carried out in the reverse order, when doing this note the following:

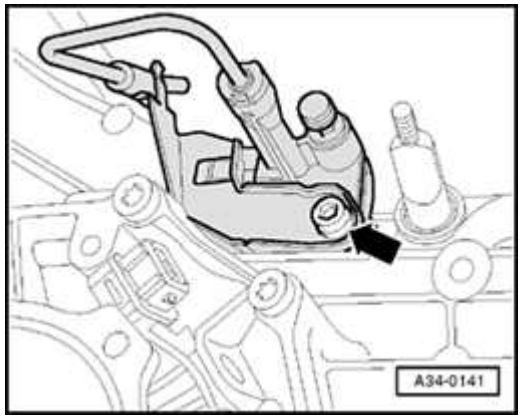
Note:

- *Do not allow brake fluid to come into contact with the transmission. If necessary, clean the transmission housing.*
- *If the clutch slave cylinder is inserted off-line there is a danger that the push rod will be guided past the clutch release lever.*
- *To facilitate installation, engage 6th gear (6-speed transmission) or 4th gear (5-speed transmission) before fitting the slave cylinder.*
- *Pre-tension the clutch slave cylinder far enough for the securing bolt to be easily inserted.*
- *Always replace securing bolt.*

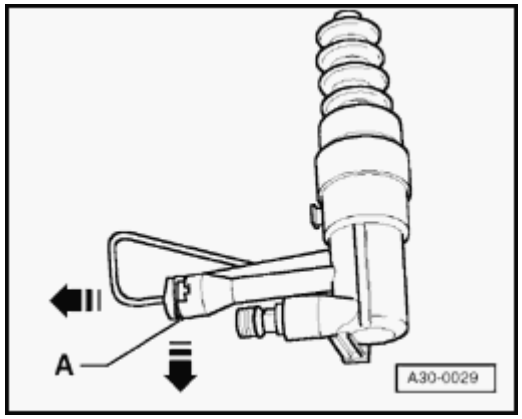
30-34



- Coat area -a- of collar with Lithium grease G 052 150 A2 before mounting the slave cylinder into the transmission housing.
- Lightly coat contact surface for plunger to clutch release lever using copper grease, e.g. Z 381 351 TE.



- Insert clutch slave cylinder into mounting hole in transmission housing, keeping it as far as possible in line with direction of operation of push rod, then tighten bolt (arrow).



- To connect line to slave cylinder, press in retaining clip -A- as far as it will go.
- Push line into slave cylinder until it engages audibly.
- Install transmission support and transmission mounting.
- Bleed clutch system ⇒ Page 30-25

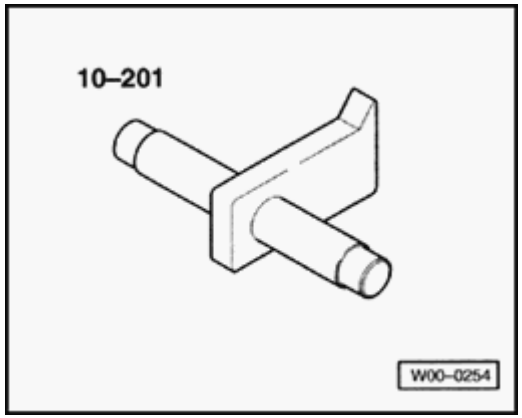
Tightening torques

Component		Nm
Clutch slave cylinder to transmission		20
Heat shield for drive axle		25
Drive axle to drive flange	M8	40
	M10	80
Transmission support to transmission		40
Transmission mounting to subframe		23

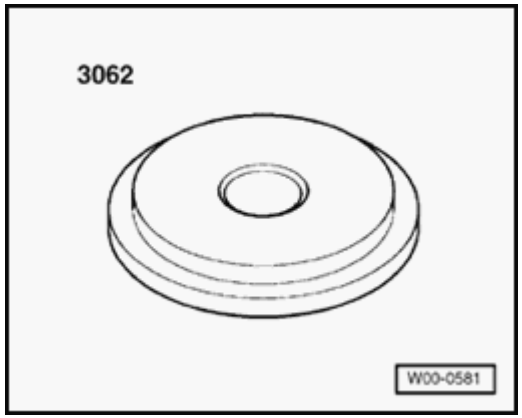
30-36

Clutch, servicing

Special tools, testers and auxiliary items required

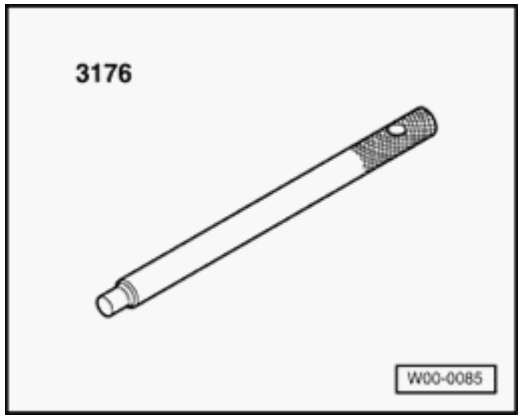


- Flywheel retainer 10-201



- Thrust pad 3062

30-37



- Centering mandrel 3176
- Grease G 000 100

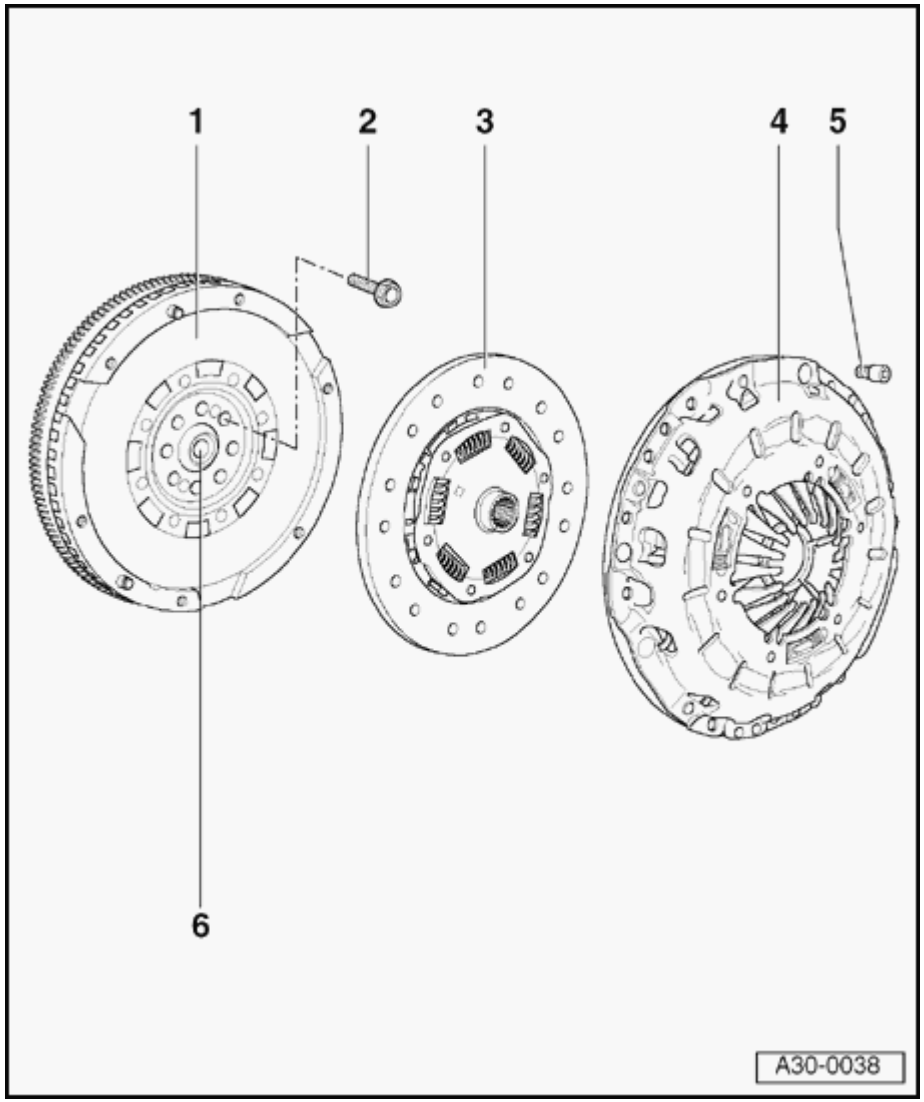
Notes:

- *Observe general repair notes ⇒ Page 00-11 .*
- *For vehicles with V6 2.7 L-Biturbo engine, a SAC-clutch plate (self adjusting clutch plate) is installed, on which an adjustment ring must be reset except during replacement ⇒ Page 30-42 .*
- *Replace clutch plates and pressure plates with damaged or loose rivets.*
- *Select the correct clutch plate and pressure plate according to engine code:*

⇒ Parts catalog

- *Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Then move clutch plate to and fro on input shaft until hub moves freely on shaft. Excess grease must be removed.*
- *Pressure plates have an anti-corrosion coating and are greased. Only the contact surface may be cleaned, otherwise the service life of the clutch will be considerably reduced.*
- *If the clutch has burned out, thoroughly clean the bellhousing, flywheel and parts of the engine facing the transmission to reduce the smell of burned linings.*

30-38



Clutch (SAC pressure plate) for vehicles with 6-cylinder 2.7 liter bi-turbo engine

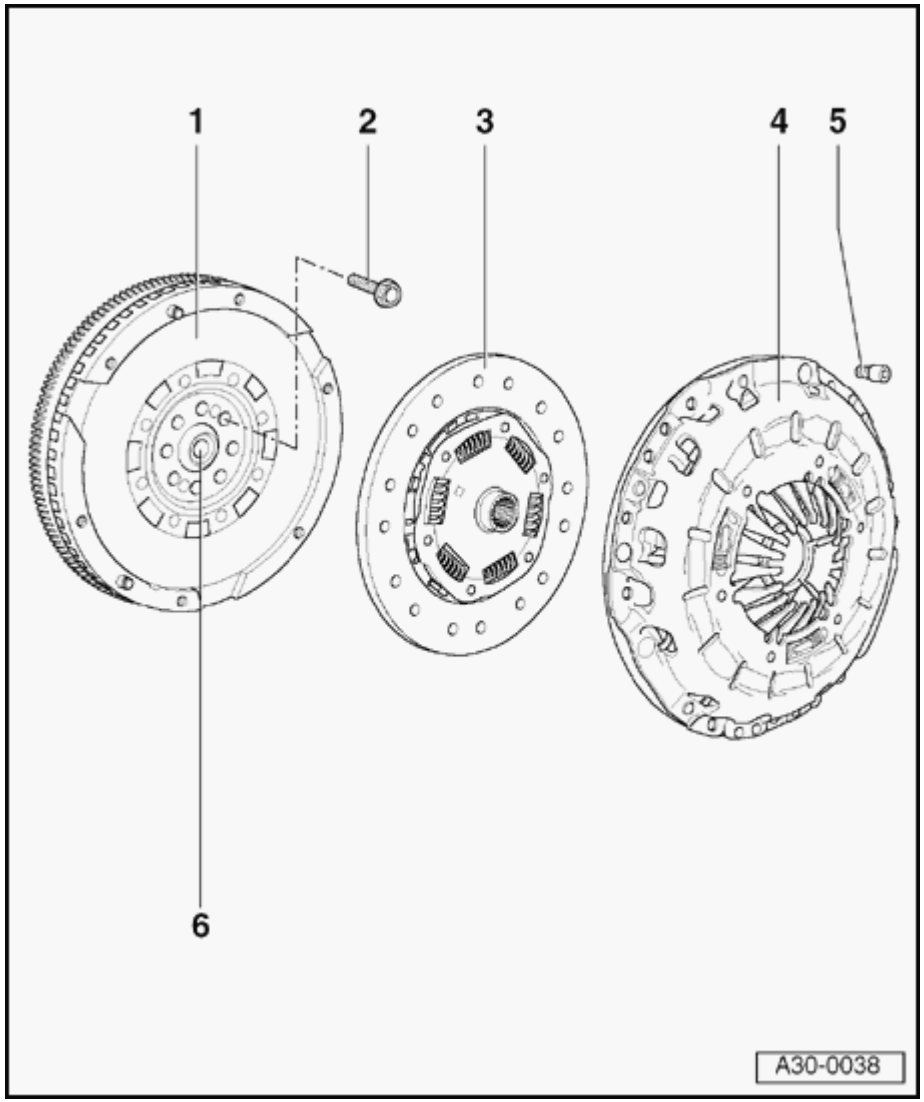
Before working on the clutch, the transmission must be removed ⇒ Page 34-18 .

1 - Dual-mass flywheel

- Ensure centering pins are tightly seated
- Contact surface for clutch lining must be free of grooves, oil and grease
- Removing and installing

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 13*

30-39



2 - Bolt

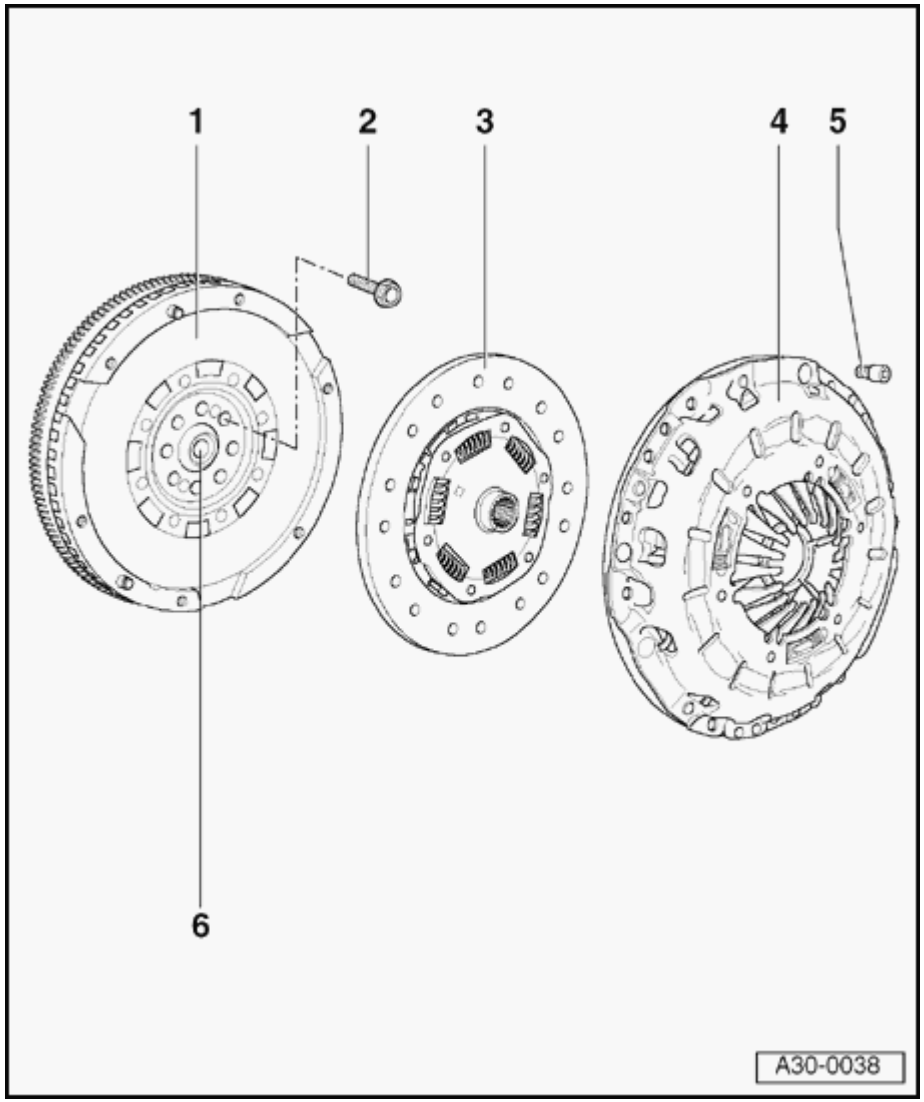
- Vehicles with dual-mass flywheel: tighten bolt to 60 Nm, then turn a further 180°
- Always replace

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 13*

3 - Clutch plate

- Install with spring pack (coil springs) or the word "Getriebeseite" towards pressure plate and transmission
- Centering ⇒ Page 30-45
- Do not grease
- Clutch plate diameter ⇒ from Page 00-3

30-40



4 - SAC pressure plate

- Removing and installing ⇒ Page 30-45
- Resetting adjuster ring ⇒ Page 30-42
- Checking ends of diaphragm spring ⇒ Fig. 1
- Checking spring connection and riveted fastenings

5 - Bolt, 22 Nm

- Tighten gradually in diagonal sequence and in several stages

6 - Needle roller bearing

- Removing and installing

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 13*

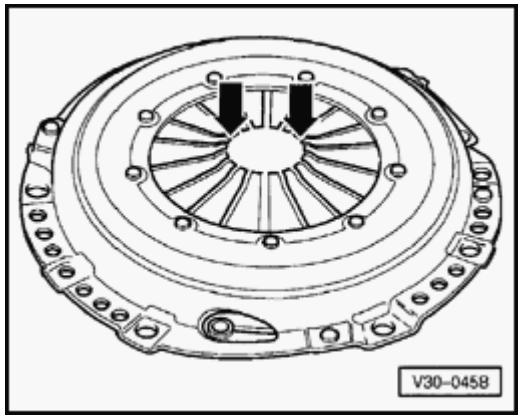


Fig. 1 Checking ends of diaphragm springs

- ♦ Wear up to half of the diaphragm spring thickness is permissible
- Check diaphragm springs and spring connection between pressure plate and cover for cracks, rivet connections and for secure fit.
- Replace clutches with damaged springs or with loose rivet connections (arrows).

Note:

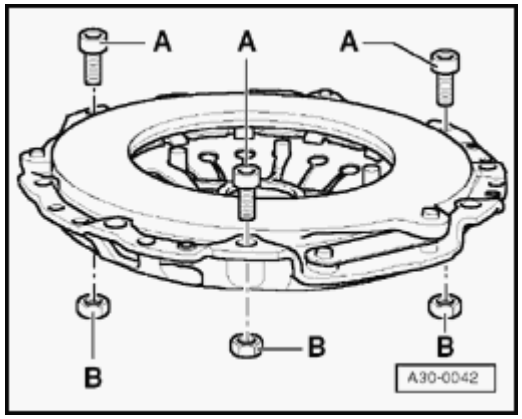
In case of repair, always allocate clutch pressure plate and clutch disc to engine code according to to parts catalog.

30-42

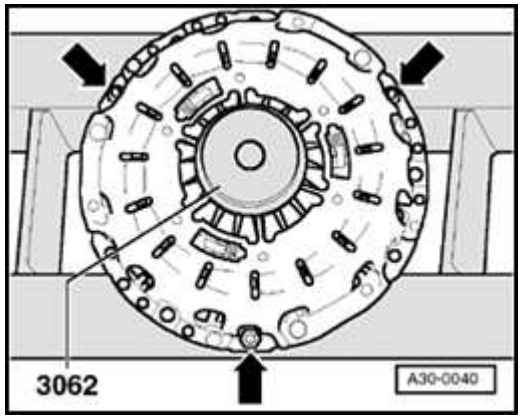
Adjuster ring in SAC clutch pressure plate, resetting

- "SAC" stands for Self-Adjusting-Clutch
- When fitting a new clutch plate together with a used SAC pressure plate, the adjuster ring in the pressure plate has to be reset by turning it back as far as it will go. If this is not done, the SAC pressure plate will operate with reduced clamping force, which will cause clutch slip and excessive wear (especially of the clutch plate). This adjustment is only required when fitting a new clutch plate together with a used SAC pressure plate, as above.
- If the clutch plate is not being replaced, it is not necessary to reset the adjuster ring.
- New SAC pressure plates are pre-set accordingly, and do not have to be reset.

30-43

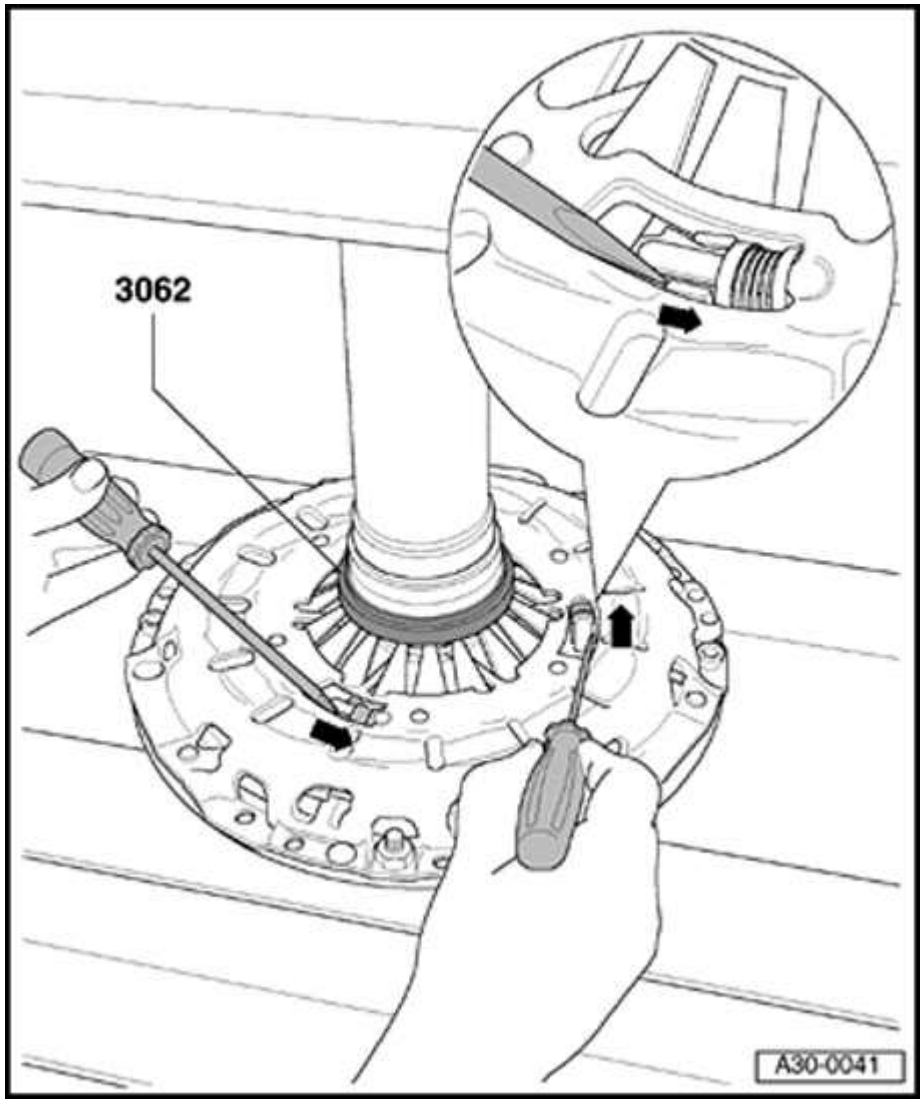


- Insert 3 securing bolts -A- into mounting holes on pressure plate, 120° from each other (1/3 turn), as shown in illustration.
- Thread 3 nuts -B- (M8) onto bolts -A- and tighten nuts slightly.



- Place SAC pressure plate onto press so that only the 3 bolt heads (arrows) make contact.
- Position special tool 3062 in center of pressure plate.

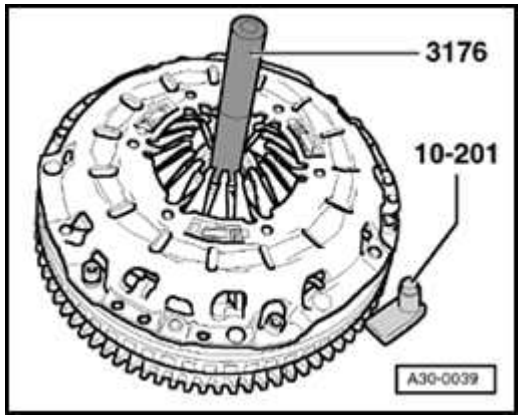
30-44



Do not use force when performing the following steps, otherwise the forks on the adjuster ring can break off.

- Apply two screwdrivers to forks on adjuster ring. Use press to compress pressure plate until it is just possible to move adjuster ring.
- Using two screwdrivers, turn back adjuster ring evenly in direction of arrows until it reaches stop.
- Hold adjuster ring against stop and reduce pressure exerted by press so that adjuster ring is held in this position.

30-45



Removing and installing clutch with SAC pressure plate

Note:

- *The adjuster ring in the SAC pressure plate has to be reset (⇒ Page 30-42) before assembly when replacing the clutch plate on its own.*
- *Clutch lining and contact surface of pressure plate must make full contact with flywheel before securing bolts are inserted.*
- *To avoid damaging centering holes in pressure plate and centering pins on flywheel, tighten securing bolts evenly and in several stages in diagonal sequence.*

- Position of clutch plate: spring pack (coil springs) or marking "Getriebeseite" towards pressure plate and transmission.
- Loosen and tighten bolts gradually in diagonal sequence and in several stages to 22 Nm.
- Reverse position of counter-hold tool 10-201 when removing.
- Use mandrel 3176 to center clutch plate.

32-1

Torque converter

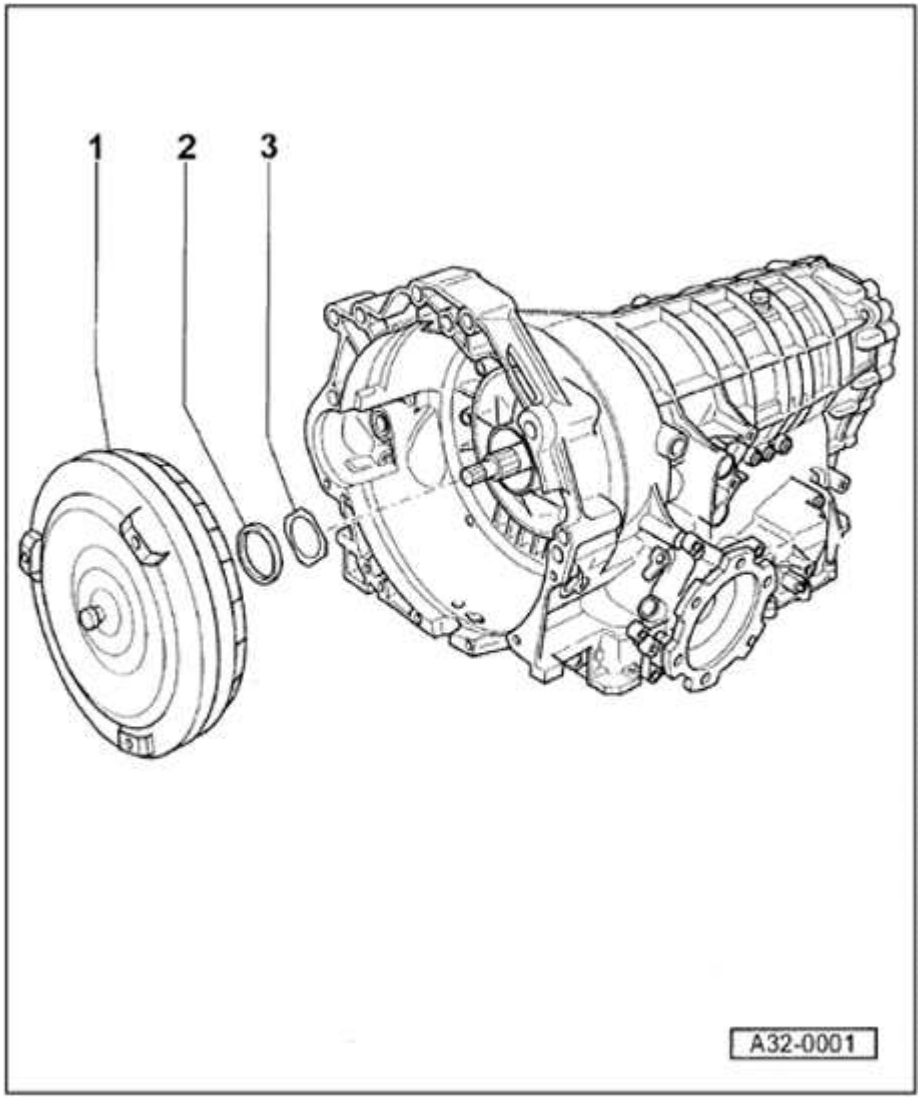
WARNING!

Check installation dimension of torque converter before installing transmission ⇒ ***page 32-8***

Notes:

- *Rules of cleanliness for working on automatic transmissions* ⇒ *page 37-148* .
- *General repair notes* ⇒ *page 00-27* .
- *Lightly coat sealing ring with ATF. Other lubricating substances lead to functional problems in the hydraulic transmission control.*

32-2



1 - Torque converter

- Secure on removed transmission to keep it from falling out.
- Identification ⇒ page 32-3
- Installing ⇒ page 32-8

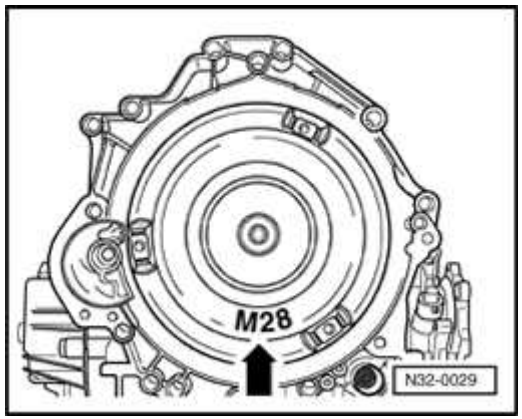
2 - Seal

- Always replace ⇒ page 32-6

3 - Contact ring

- Behind sealing ring
- Replace if damaged

Torque converter, identification

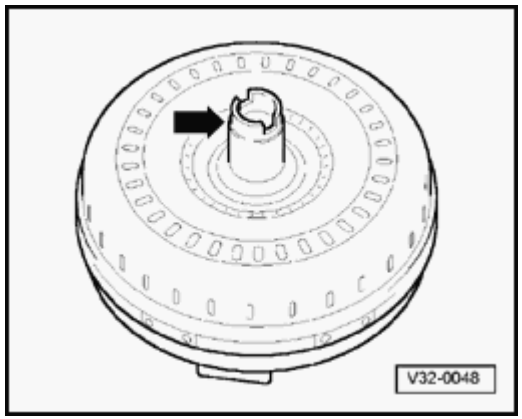


Different types of torque converters exist. Identification is performed via code letters (arrow).

Allocation of torque converter/transmission ⇒ page 00-4 .

32-4

Torque converter, checking



- Checking converter hub for wear grooves (arrow).

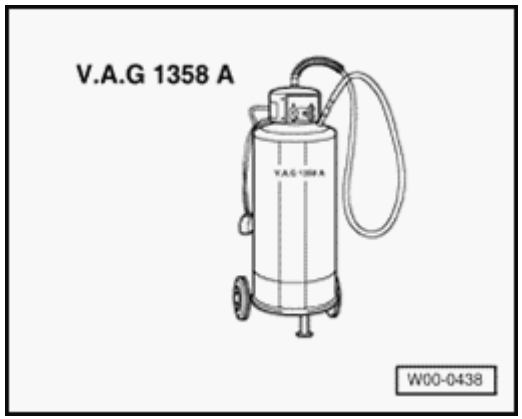
Note:

The torque converter is welded in and must be completely replaced if damaged or in case of malfunctions.

32-5

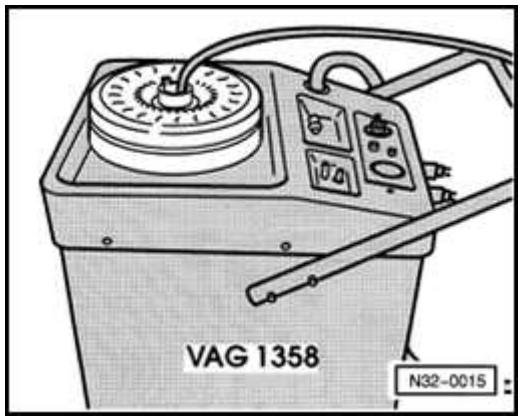
Torque converter, draining

Special tools and equipment



- VAG1358A - oil siphoning unit
- V.A.G 1358 A/1 oil syphoning probe

In case of soiling of the ATF via shavings or during a major transmission overhaul, torque converter must be drained.

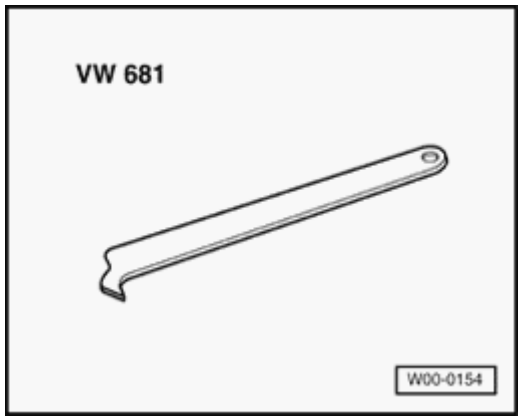


- Drain ATF from torque converter using VAG1358A and oil syphoning probe VAG1358A/1.

32-6

Torque converter oil seal, replacing

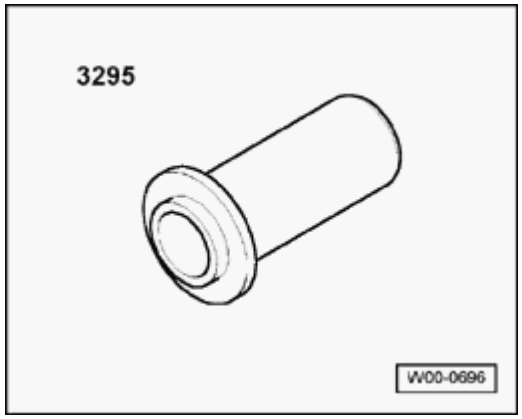
Special tools and equipment



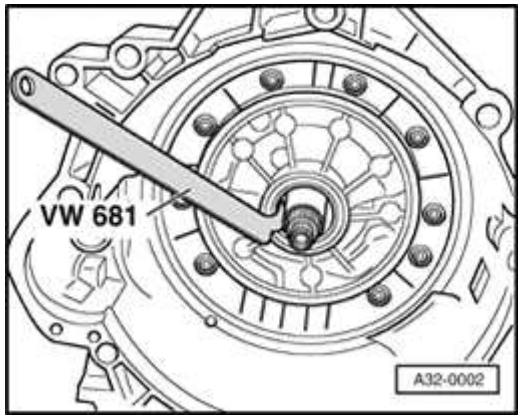
- VW681 extractor lever
- 3295 thrust piece

Removing

- Removing transmission ⇒ page 37-71 .



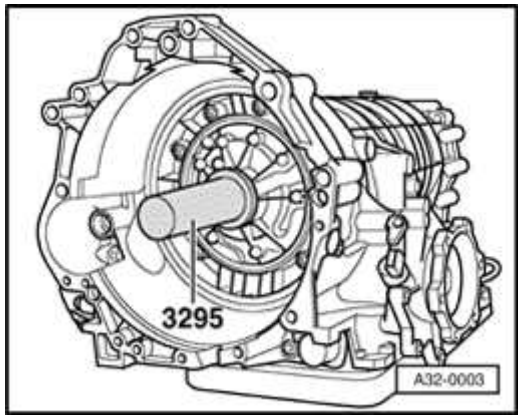
- Secure transmission to transmission mount ⇒ page 37-131 or place on flat surface.



- Insert VW681 extractor lever directly behind the sealing lip of the sealing ring, so that the contact ring which is behind it is not damaged.

Installing

- Insert contact ring.
- Coat outer circumference and sealing lips of sealing ring with ATF.
  - Installation position: The open side of the sealing ring faces the transmission.



- Using 3295 thrust piece, drive in sealing ring for torque converter up to thrust piece stop.

32-8

Torque converter, installing

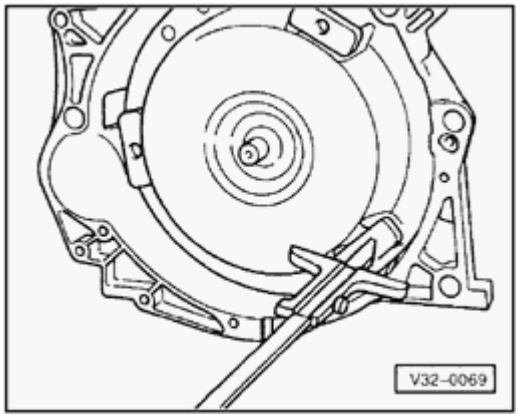
Special tools and equipment

- Depth gauge

- Slide in converter hub through the sealing ring up to the first stop.

- Rotate torque converter inward with light pressure, until the groove of the torque converter hub engages in the coupling plate of the pump wheel and the torque converter slides inward noticeably.

Installation dimension



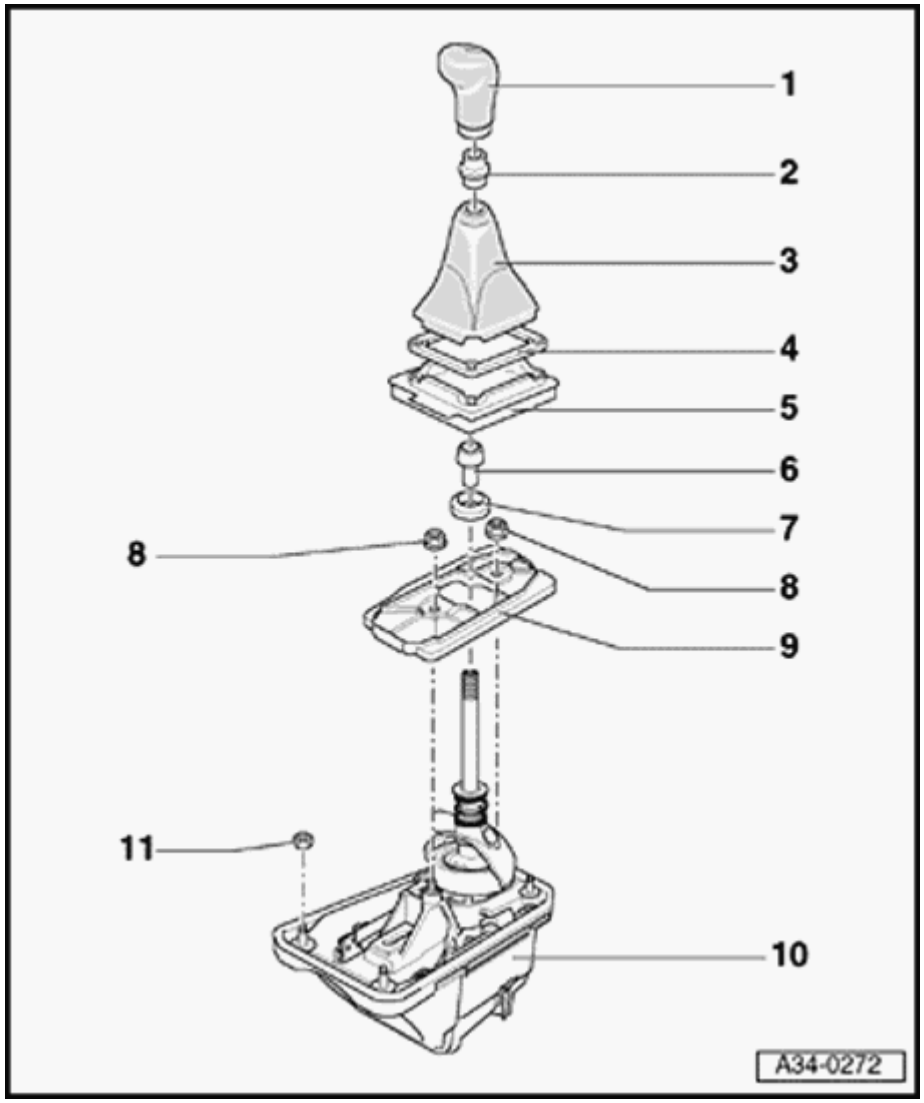
If the Torque converter is inserted properly, the dimension between the surface of the mounting eyes and the surface of the torque converter housing is at least 23 mm.

If the torque converter is not inserted completely, this distance will be approx. 11 mm.

WARNING!

In case of an incorrectly inserted torque converter, the coupling plate of the torque converter or the ATF-pump will be destroyed, if the transmission is flanged to the engine.

34-1



Shift control mechanism, servicing

Part I

Notes:

- *Grease bearings and sliding surfaces with polycarbamide grease, part nr. G 052 142 A2.*
- *Adjusting shift control mechanism* ⇒ *Page 34-12* .

1 - Shift knob

2 - Bushing

3 - Housing cover

- Carefully pry out latch in rear section of center console

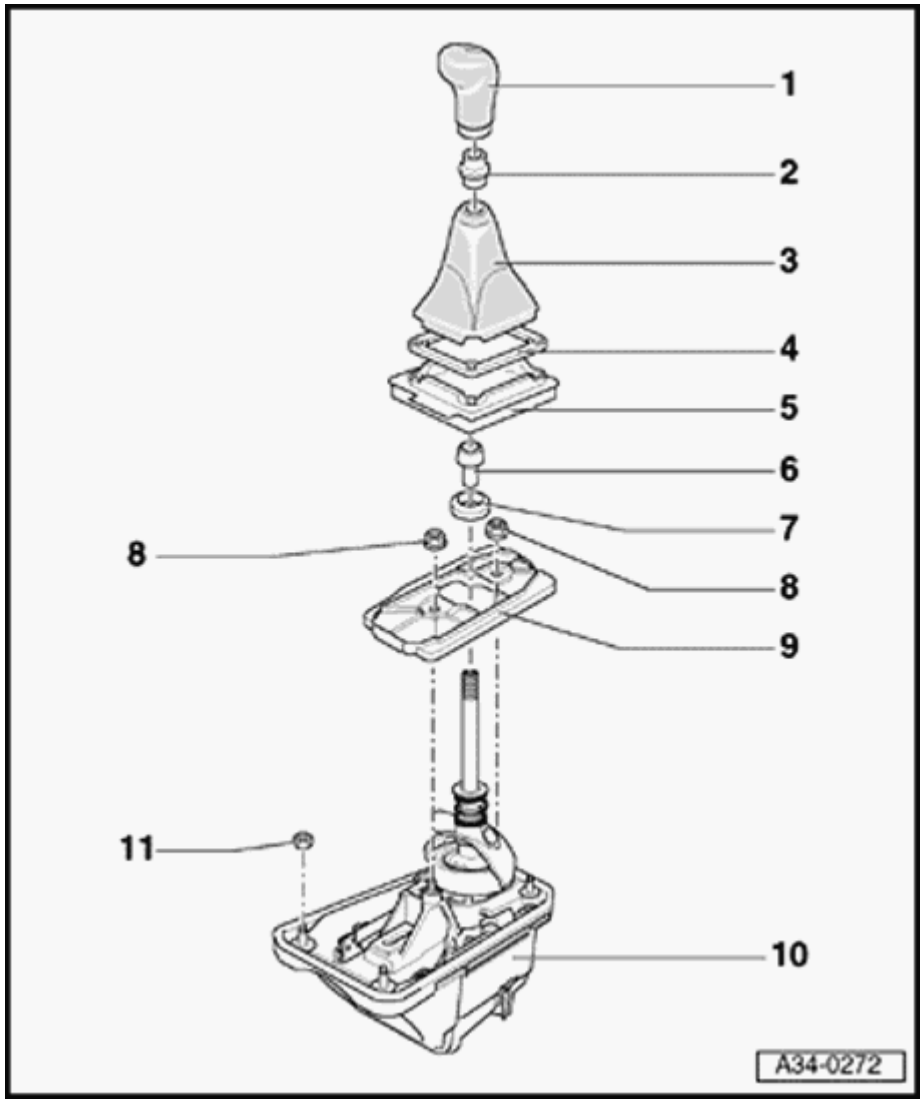
4 - Top part of retaining frame

5 - Bottom part of retaining frame

6 - Bushing

7 - Sleeve

34-2



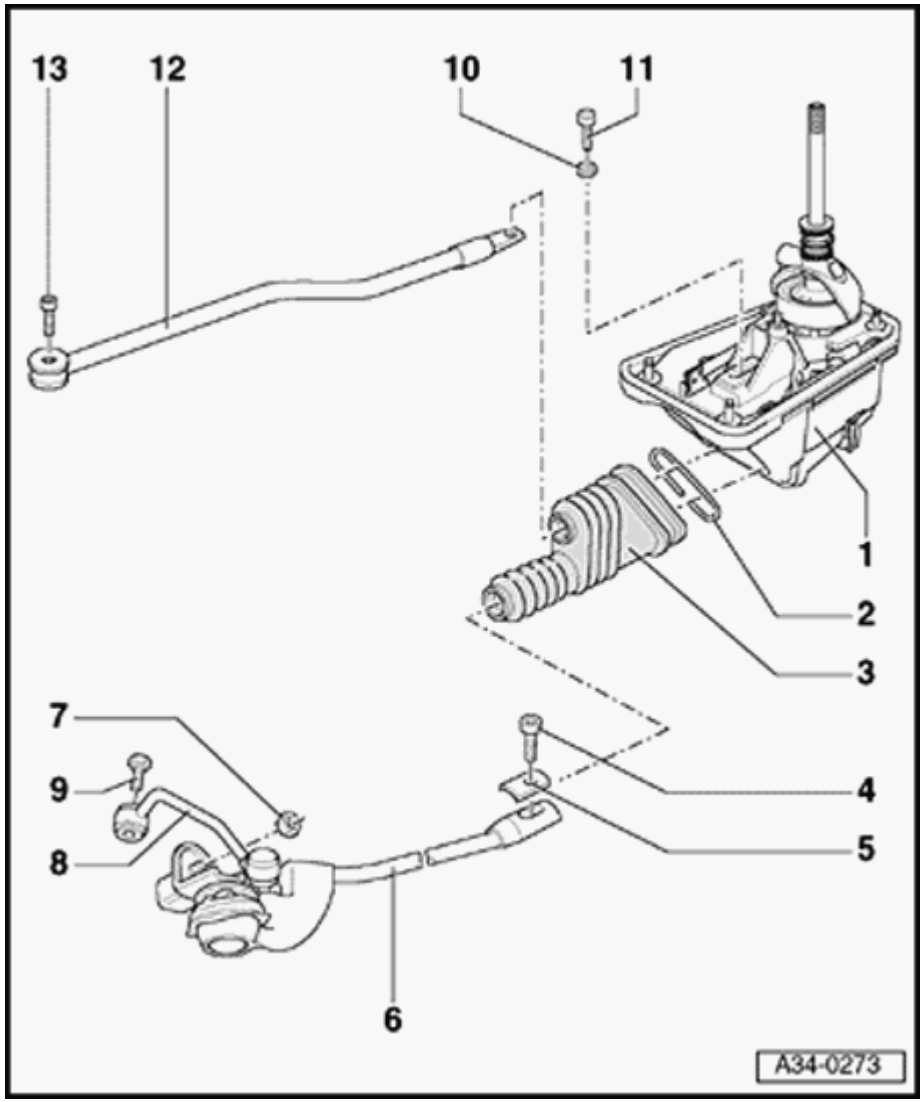
8 - Nut, 8 Nm

9 - Noise insulation cover

10 - Shift control mechanism with shift housing

11 - Nut, 10 Nm

34-3



Part II

1 - Shift control mechanism with shift housing

2 - Tensioning ring

3 - Boot

- Carefully pull over shift rod during removal
- Set onto marks of shift rod and pivot rod when installing

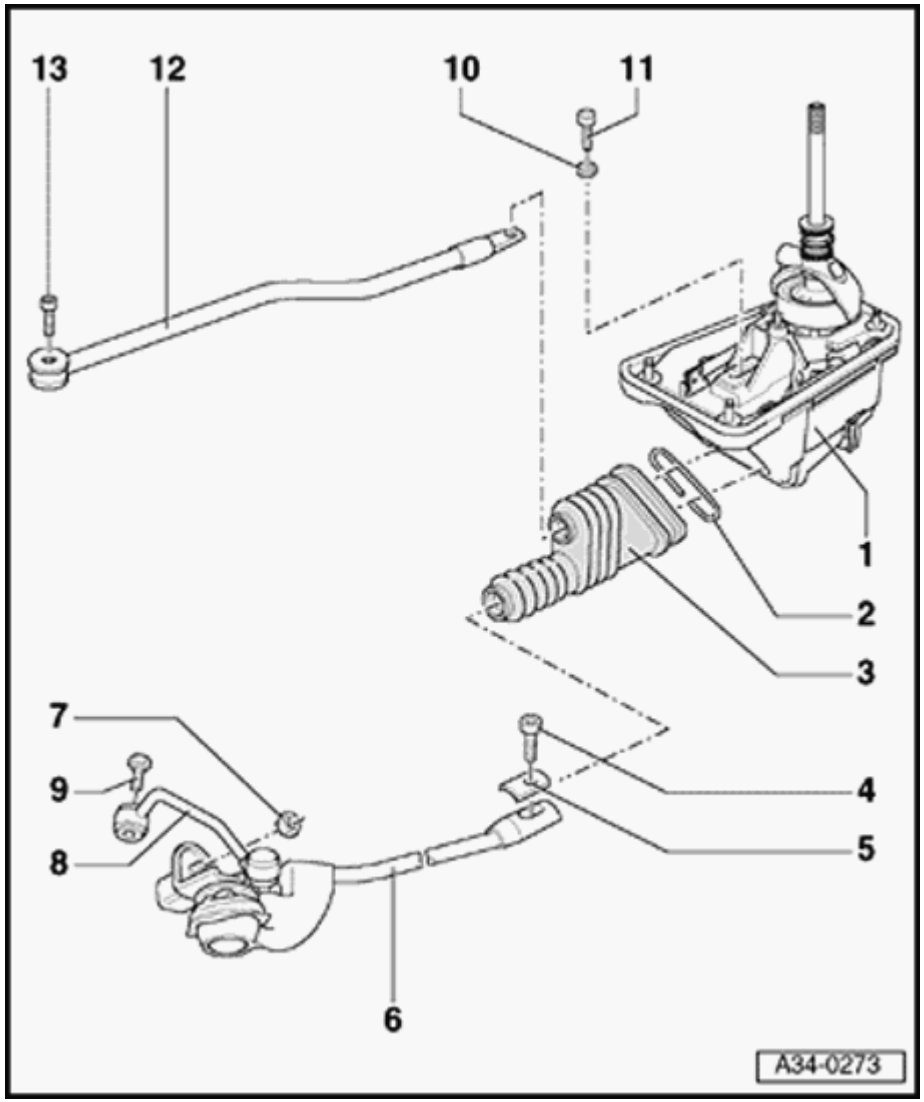
4 - Socket head bolt, 25 Nm

5 - Clamp

6 - Shift rod

- Do not disconnect connecting rod Fig. -8- from shift rod; observe note ⇒ Page 34-9

34-4



7 - Nut, 25 Nm

8 - Connecting rod

- Do not disconnect from shift rod; observe note ⇒ Page 34-9

9 - Bolt, 25 Nm

10 - Washer

11 - Socket head bolt, 25 Nm

12 - Front shift rod

- With bearing bushing, bolt and washers

13 - Bolt, 40 Nm

- Part of front shift rod

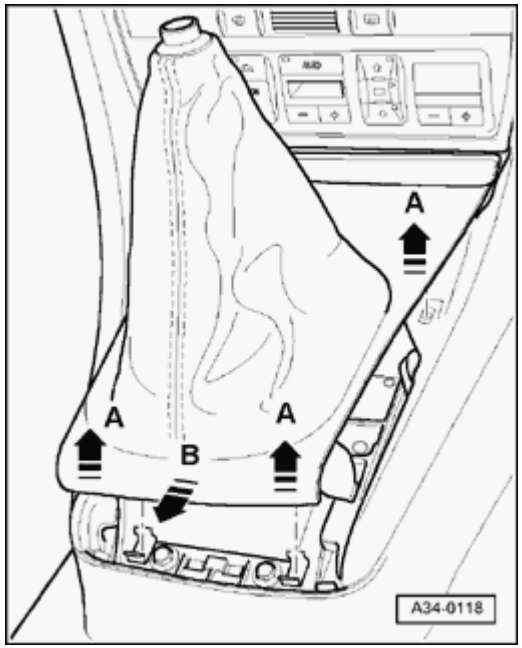
Selector mechanism, removing and installing

Removing

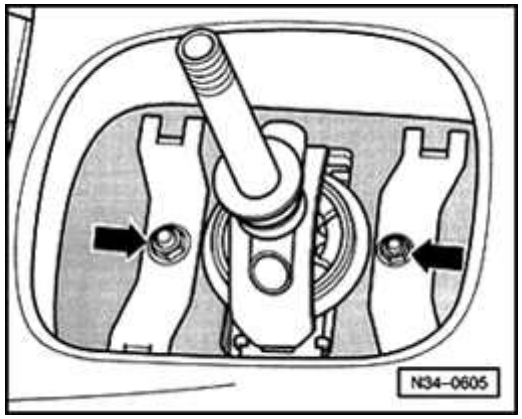
- Unscrew shift knob from shift lever.

Note:

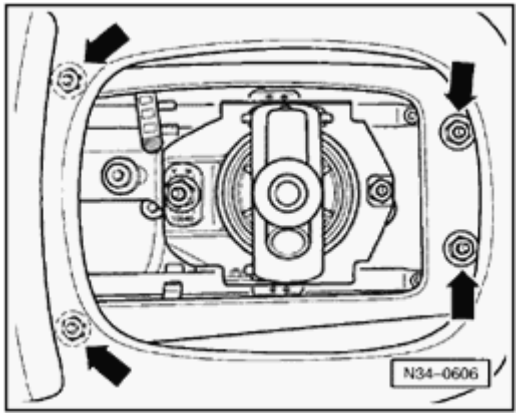
Shift cover is removed together with the cover for center console.



- Slightly lift off cover for center console upward (arrows -A-).
- Pull cover slightly toward back (arrow -B-), then lift complete cover upward.

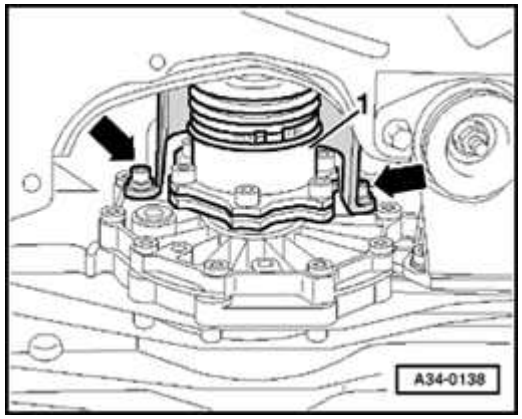


- Remove noise insulation cover for shift mechanism housing (arrows).



- Unscrew nuts securing shift mechanism housing (arrows).

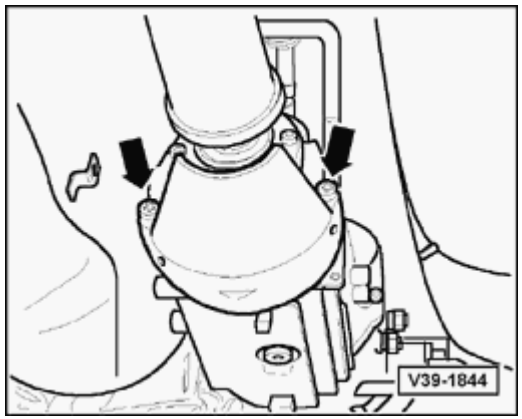
34-7



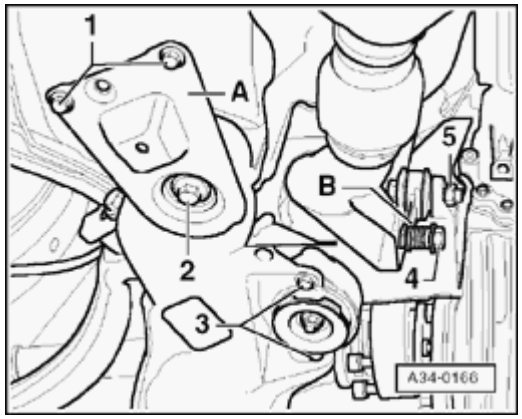
- Remove heat shield for left-hand inner joint -1- from transmission (arrows).
- Disconnect left-hand drive axle -1-, lift toward front and tie up.
- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

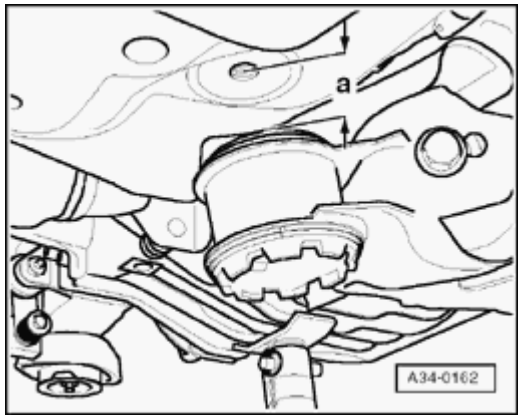
- Remove heat shield above driveshaft.



- Remove heat shield for driveshaft from cover for Torsen differential (arrows).
- Remove driveshaft ⇒ Page 39-68 .



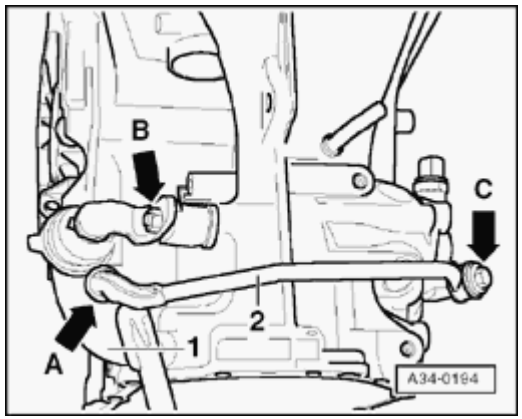
- Unscrew bolts -1- and -2- on left and right.



- Lower subframe at the rear.

◆ -a- = max. 50 mm

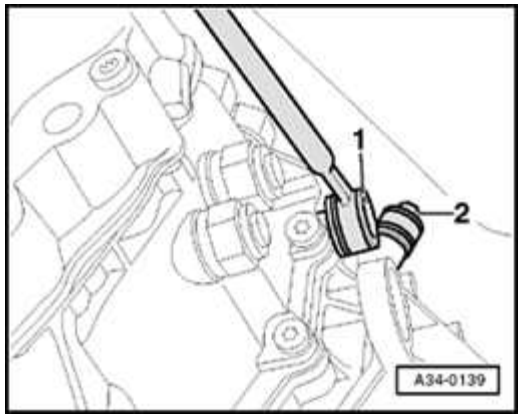
Important notice for the following procedures:



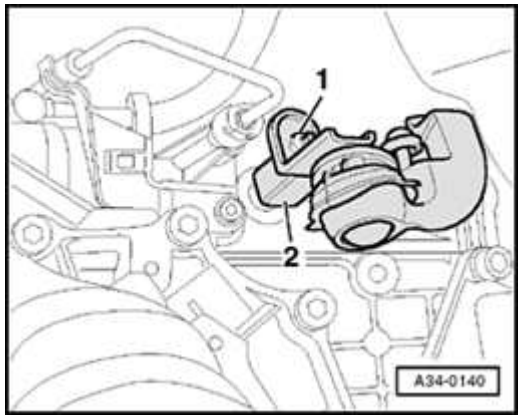
Under no circumstances may the ball head (arrow -A-) of connecting rod -2- be pulled off shift rod -1- during removal of shift linkage.

The ball head is destroyed when pulled off.

Nut (arrow -B-) and Bolt (arrow -C-)must be removed to remove shift rod.



- Unbolt connecting rod -2- on right-hand side of transmission.
- Remove hex socket head bolt from push rod -1-.



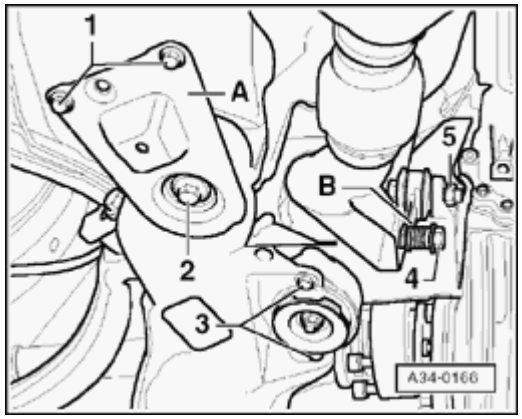
- Unscrew nut -1- and pull selector rod lever -2- off transmission selector shaft.
- Swing gear shift housing with selector rod and push rod down and remove.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Bolt on driveshaft ⇒ Page 39-71 .
- Adjust driveshaft ⇒ Page 39-75 .
- Adjust gear selector mechanism ⇒ Page 34-12 .
- Align exhaust system free of stress

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*



Tightening torques

Component		Nm
Hex bolt -1-		75
Combi bolt -2-		110 + 90°
Gear shift housing to body		10
Selector rod to transmission		25
Connecting rod to transmission		25
Push rod to transmission		40
Drive axle to drive flange	M8	40
	M10	80
Heat shield for drive axle		25
Clamp for exhaust pipe		40

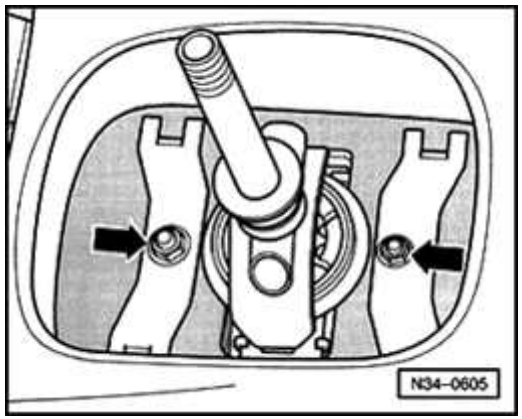
34-12

Gear selector mechanism, adjusting

Requirements

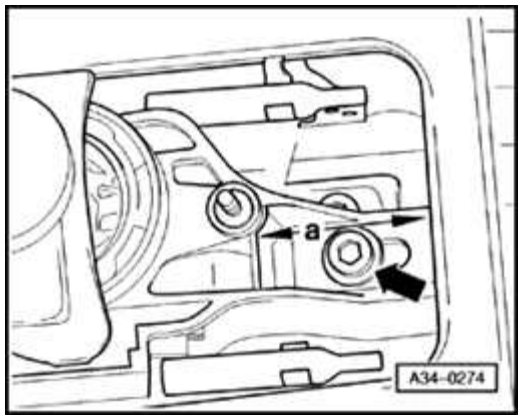
- Selector mechanism, operating and relay elements must be in proper condition.
- Selector mechanism must move freely.
- Transmission, clutch and clutch mechanism must be in proper condition.
- Transmission in neutral.

- Unscrew gear shift knob from gear shift.
- Remove cover (gaiter) for gear shift.



- Remove noise insulation for selector mechanism housing (arrows).

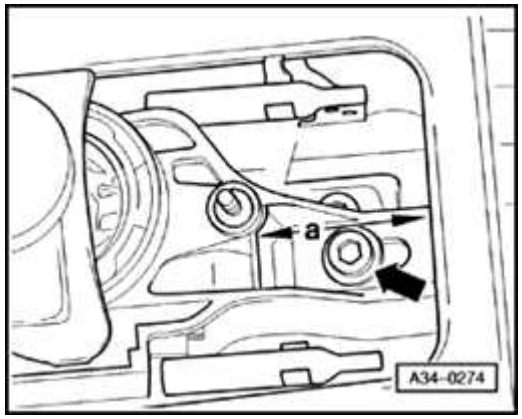
- Measure distance between body and rear push rod (in selector mechanism).



➢

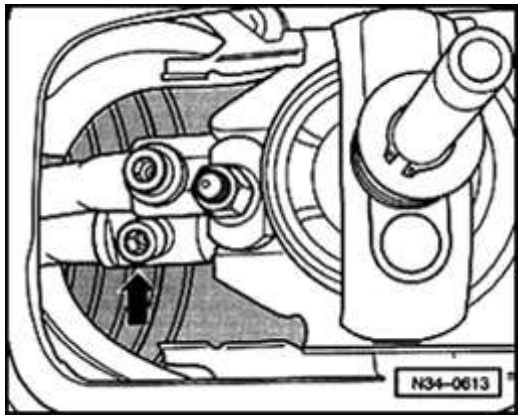
- ♦ Specification: distance a = 43 mm

If that is not the case, obtain distance -a- as follows:



➢

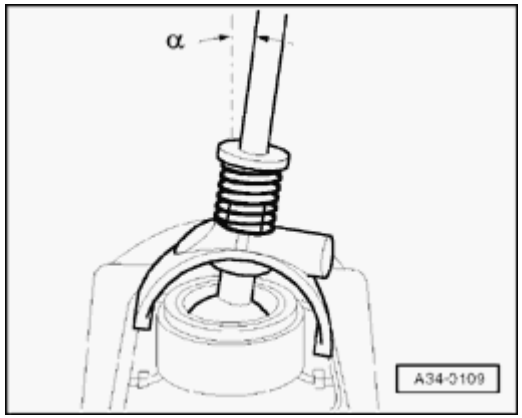
- Loosen bolt (arrow) for pivot rod.
  - ♦ Rear pivot rod (in shift control mechanism) must move freely back and forth on sliding piece.
- Adjust measurement -a- by moving pivot rod rear (in shift control mechanism).
- Tighten bolt for pivot rod to 25 Nm.



- Loosen bolt for selector rod (arrow).

  Connection between selector rod and selector mechanism should move freely.

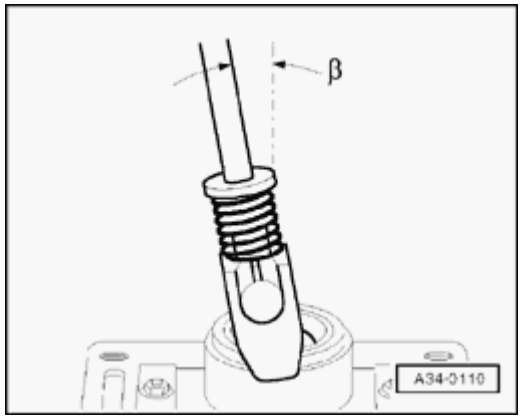
- Adjust gear shift as follows:



- Gear shift vertical, maximum inclination of 3° to the right (angle α)

Note:

The illustration shows the gear shift from behind (looking towards the front of the vehicle).



➢

- Gear shift inclined slightly backwards (approx. 7 °, angle b)

Note:

The illustration shows the gear shift from the right.

- Hold gear shift in this position.
- Tighten selector rod bolt to 25 Nm.

Note:

The gear shift must remain in the same position while the bolt is being tightened.

Gear shift adjustment, checking

- The gear shift lever must rest in the 3rd/4th gear gate when transmission is in neutral.

- Check operation of 1st and 2nd gear stop.

- Engage 2nd gear and push gear shift to the left against the stop.

- Reduce pressure on gear shift until it moves back to pressure point.

  Spring-back measured at gear shift handle: 3-5 mm

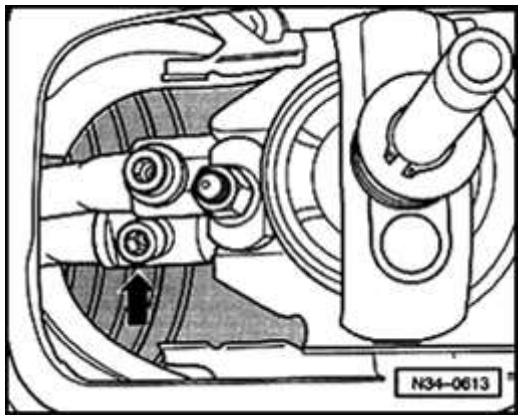
- Check that all gears can be engaged.

- Check operation of reverse gear lock.

  - It should only be possible to engage reverse gear after pressing the gear shift down to overcome the reverse gear lock.

  - It must be possible to move the gear shift, without pushing and without force, forwards from the reverse gear lock to the 3rd/4th gear plane

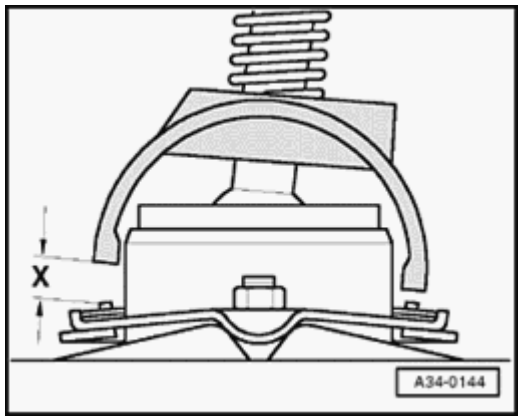
- If the gear shift setting is incorrect it can be adjusted as follows:



- Loosen bolt for selector rod (arrow).

Note:

The angle of forwards/backwards inclination of the gear shift must not be changed while the following adjustments are being made.



- Move gear shift to the left or to the right until distance "x" is 8.5 mm.
- Hold gear shift in this position.
- Tighten selector rod bolt.

Tightening torques

Component	Nm
Selector rod to selector fork (in selector mechanism)	25

- Check gear shift setting again.
- Fit covers and gear shift knob.

34-1

Shift linkage, servicing

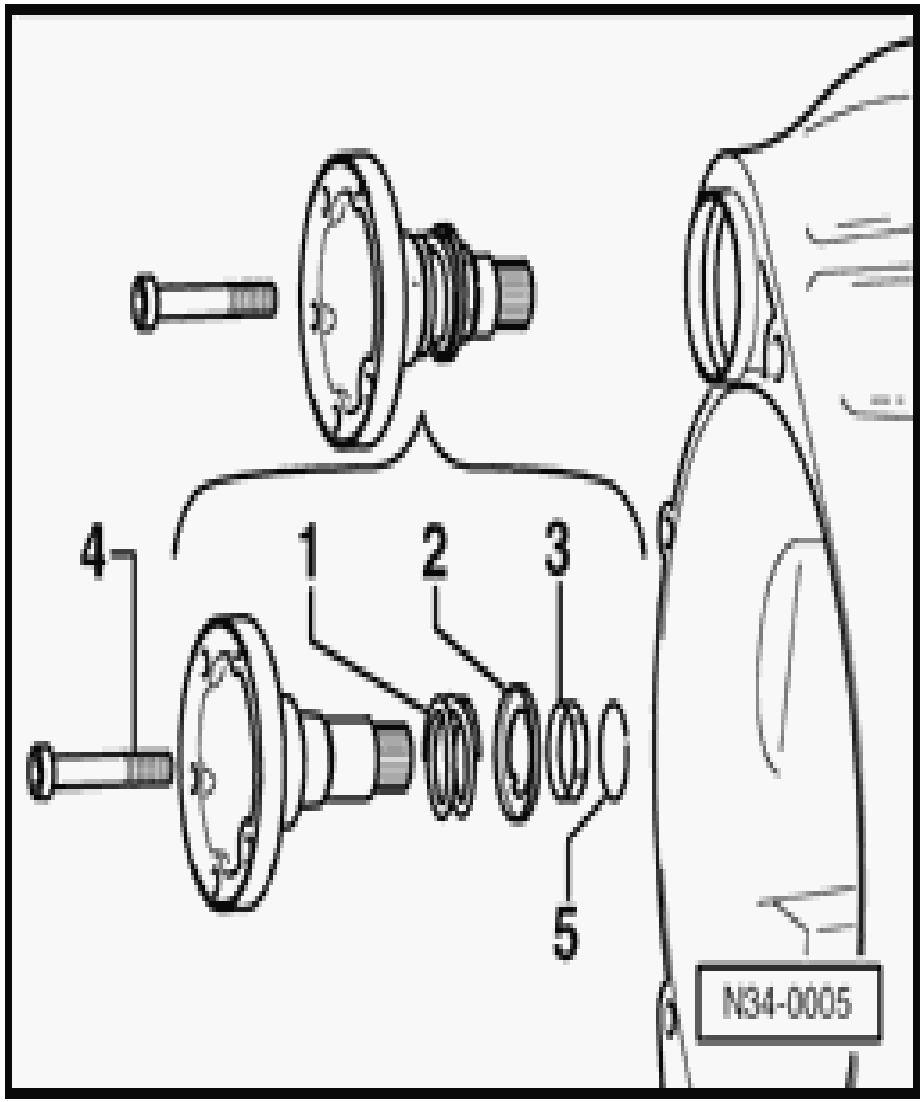
Notes:

- *Lubricate bearing areas and slide surfaces with Polyuric grease G 052 142 A2.*
- *Adjusting shift linkage ⇒ Page 34-12 .*
- *To remove the complete shift linkage, remove the exhaust system.*

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- *To disassemble the shift linkage in the installation position, the shift mechanism housing must be lowered.*

34-2



1 - Shift knob

2 - Bushing

3 - Housing cover

- Carefully pry out latch in rear section of center console

4 - Top part of retaining frame

5 - Bottom part of retaining frame

6 - Bushing

7 - Sleeve

8 - Circlip

- Do not over-stretch when installing

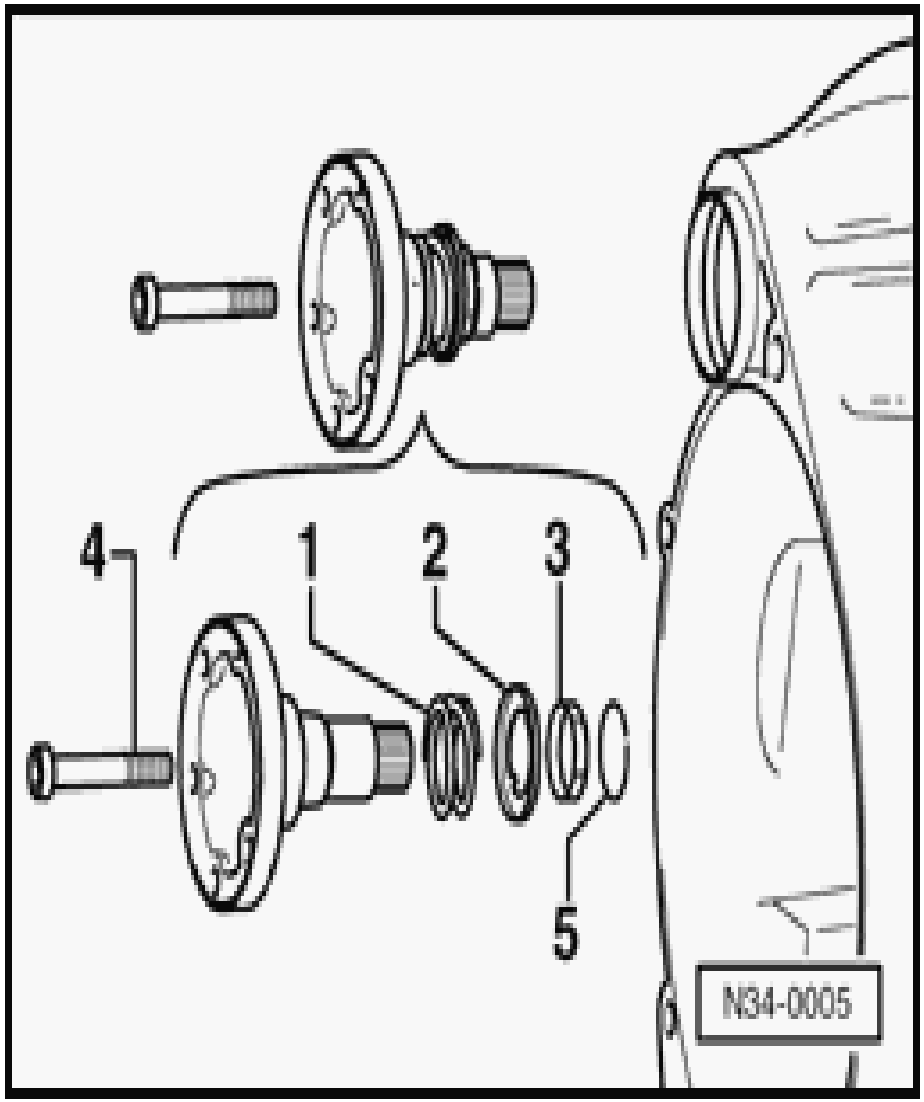
9 - Spacer bushing

10 - Compression spring

11 - Ball stop

- Insert compression spring and bushing into the ball stop and assemble on shift mechanism so that compression spring and bushing are on right (direction of travel)
- Install circlip (item - 23 -) before installing

34-3



12 - Compression spring

13 - Bushing

- Rounded side faces shift lever

14 - Shift lever

- Can be installed into ball housing in one position only

15 - Spacer tube

16 - Nut

- 8 Nm (71 in. lb)

17 - Nut

- 8 Nm (71 in. lb)

18 - Cover

19 - Nut

- 10 Nm (7 ft lb)

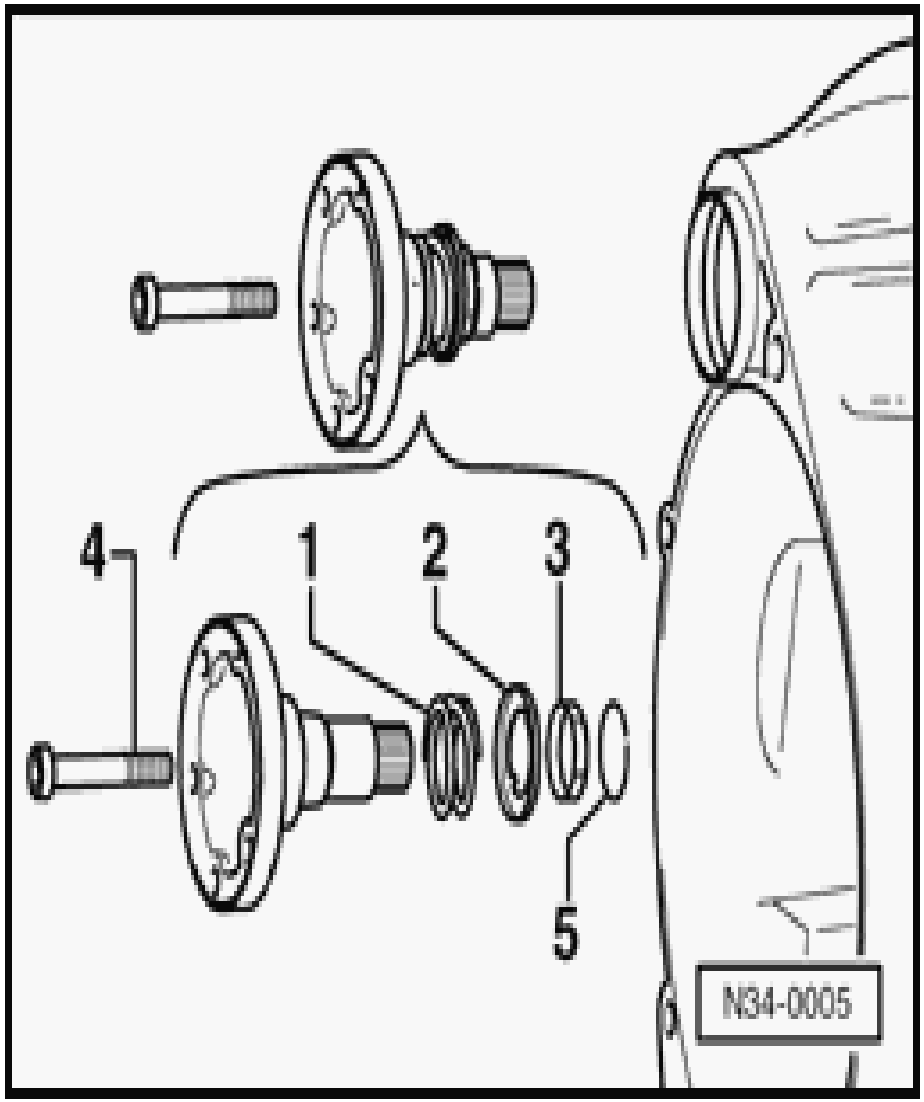
20 - Connecting piece

21 - Nut

- 23 Nm (17 ft lb)

22 - Connecting piece

34-4



23 - Circlip

- Always replace
- Remove before removing ball stop
- Rounded side faces ball housing (item - 25 -)

24 - Buffer

25 - Ball housing

- Buffers for ball stop on left and right must be in place
- Insert so that shift detent for reverse gear faces toward left

26 - Rear shift rod

27 - Bolt

- 10 Nm (7 ft lb)

28 - Bolt

- 23 Nm (17 ft lb)

29 - Washer

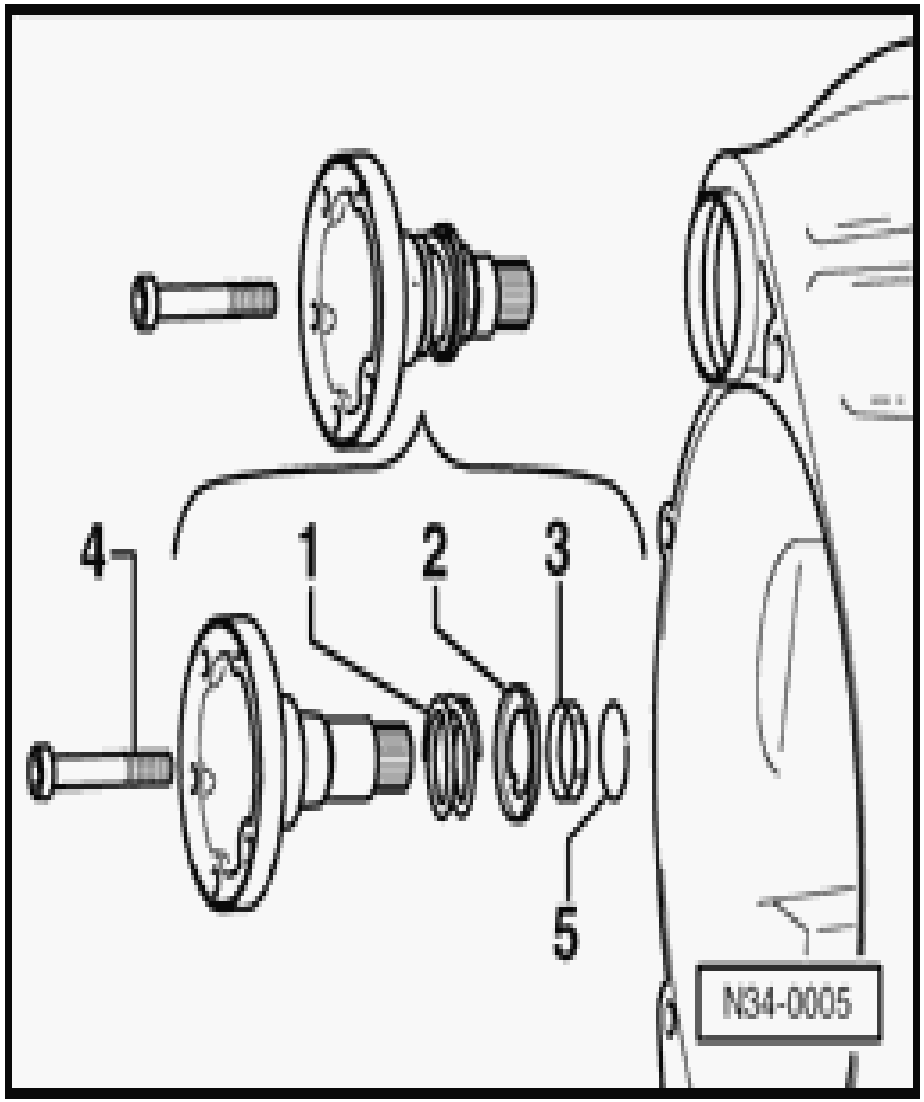
30 - Shift mechanism housing

31 - Nut

- 10 Nm (7 ft lb)

32 - Bolt

34-5



33 - Nut

- Always replace
- 10 Nm (7 ft lb)
- Self locking

34 - Shift fork

35 - Bolt

- 23 Nm (17 ft lb)

36 - Clamp

37 - Shift rod

- With shift coupling

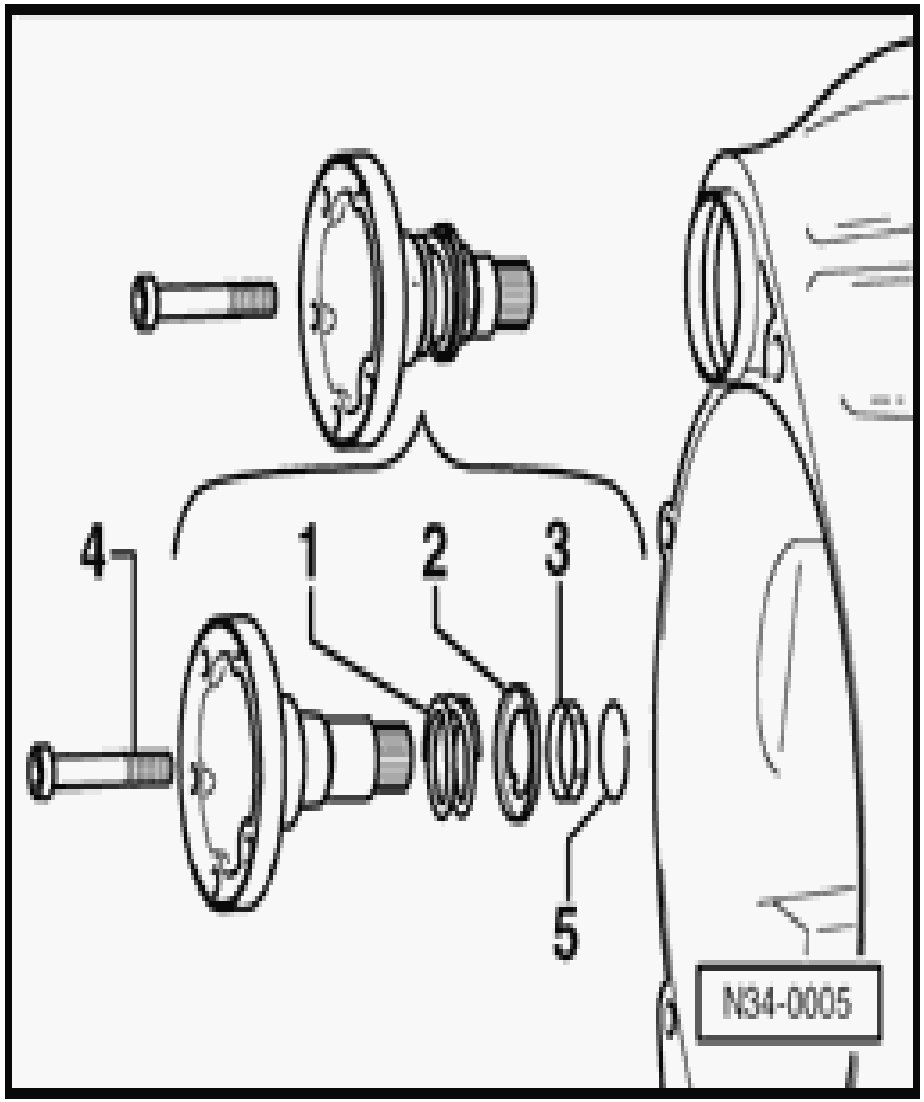
38 - Bolt

- Always replace
- 23 Nm (17 ft lb)
- Self locking

39 - Pivot rod

- Avoid tension by first connecting pivot rod to shift mechanism housing and rear shift rod
- Hold bolt (item -42-) in place when tightening nut (item -41-)
- Pivot rod, fastening 06.96 ⇒ Fig. 1

34-6



40 - Bolt

- 40 Nm (30 ft lb)

41 - Nut

- 40 Nm (30 ft lb)

42 - Bolt

43 - Mounting bracket for pivot rod

- Revised after 06.96 ⇒ Fig. 1
- Mounting bracket shown used ➢05.96
- Pivot rod, fastening 06.96 ➢ ⇒ Fig. 1

44 - Tensioning ring

45 - Boot

- To remove and install, remove Three Way Catalytic Converter (TWC) and heat shield
- Carefully pull over shift rod and pivot rod
- When installing, place on markings of shift rod and pivot rod

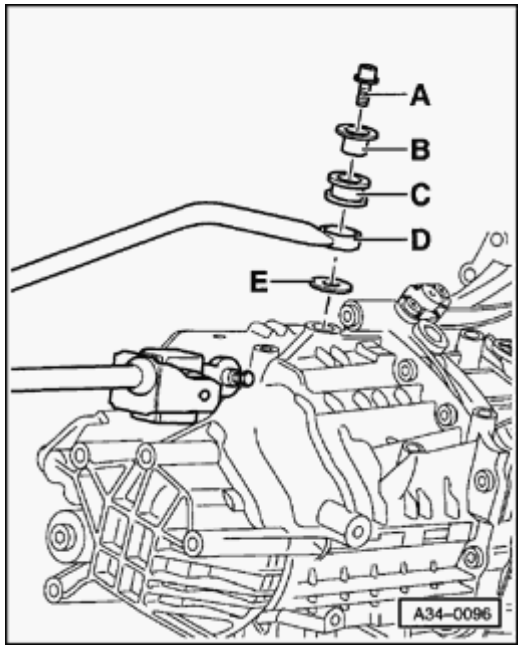


Fig. 1 Pivot rod fastening to transmission 06.96

As of 06.96 the pivot rod is bolted directly to the transmission cover. The additional mounting bracket (⇒ Page 34-6 , item -43-) and its bolts are deleted. For this reason the transmission cover was revised and equipped with an additional mounting point.

A - Socket-head bolt

40 Nm (30 ft lb)

B - Washer

Rounded side faces pivot rod

C - Rubber bushing

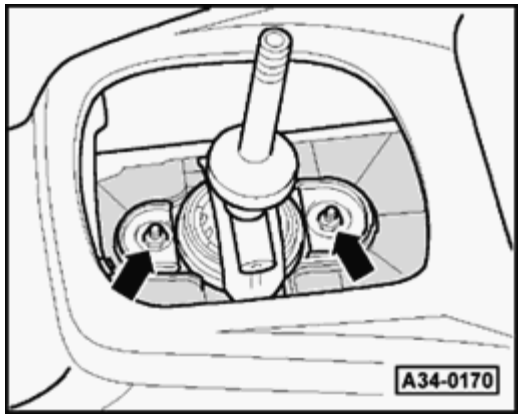
D - Pivot rod

E - Washer

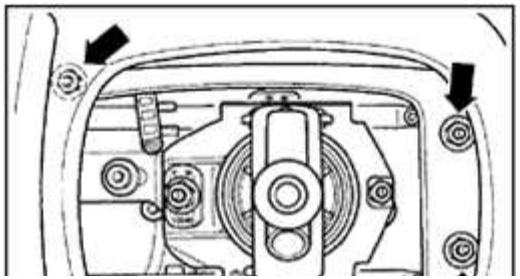
Shift mechanism, removing and installing

Removing

- Remove shift knob and housing cover.
- Remove center console ⇒ Repair Manual, Body Interior, Repair Group 70.
- Remove cover.



- Remove cover for shift mechanism housing (arrows).

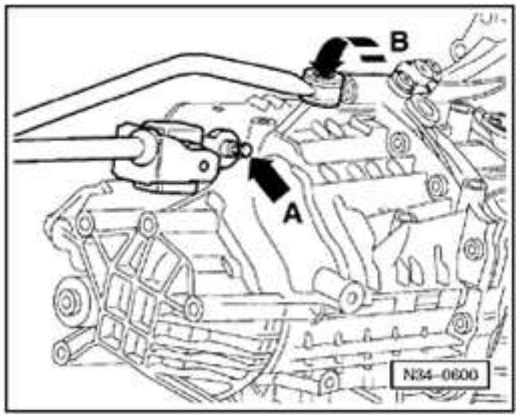


- Remove nuts securing shift mechanism housing (arrows).

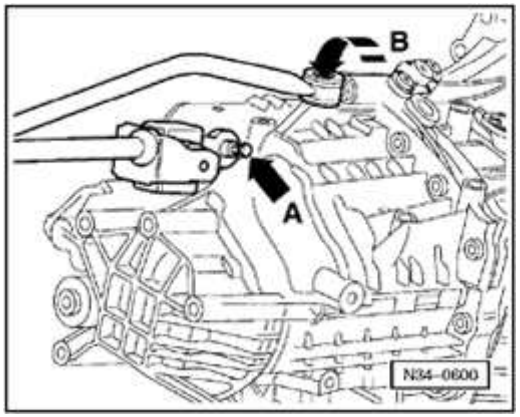
- Separate exhaust system behind Three Way Catalytic Converter (TWC); if necessary remove front exhaust system together with Three Way Catalytic Converter (TWC).

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

- Remove heat shield.



- Remove shift rod (arrow -A-).
- Remove socket-head bolt on pivot rod (arrow -B-).
- Swing shift mechanism housing together with shift rod and pivot rod downward and remove.



Installing

Install in reverse order of removal, noting the following:

- Push shift rod on so that securing bolt fits into recess of shift rod.

➢

- Secure shift rod (arrow -A-).
- Secure pivot rod to transmission (arrow -B-).
- Adjust shift linkage ⇒ Page 34-12 .
- Install heat shield.
- Align exhaust system free of stress.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

Tightening torques

Component	Tightening torque
Shift mechanism housing to body	10 Nm (7 ft lb)
Shift rod to transmission	23 Nm (17 ft lb)1)
Pivot rod to transmission	40 Nm (30 ft lb)
1) Always replace bolt.	

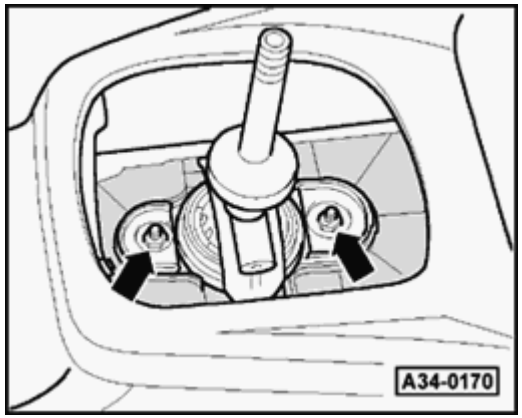
34-12

Shift linkage, adjusting

Requirements

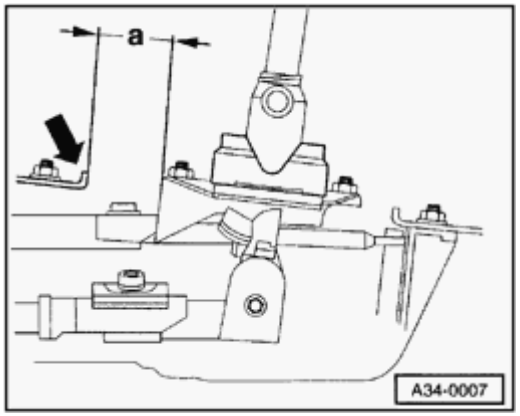
- Components of shift mechanism and linkage must be in proper working condition
- Shift mechanism must move freely
- Transmission, clutch and clutch assembly must be in proper working condition
- Transmission in neutral

- Remove shift knob and housing cover.



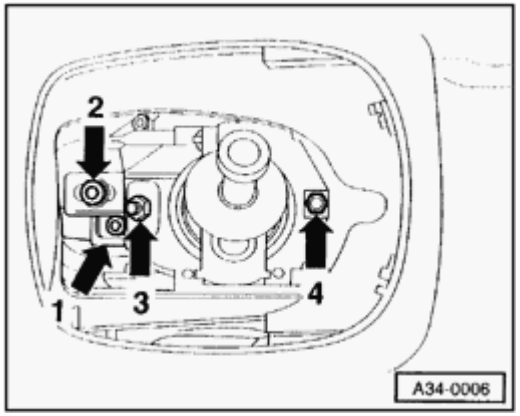
- Remove cover for shift mechanism housing (arrows).

- Measure dimension between body opening and rear shift rod (in shift mechanism).



Dimension -a-: 37 mm (1.46 in.).

If dimension -a- is not attained:

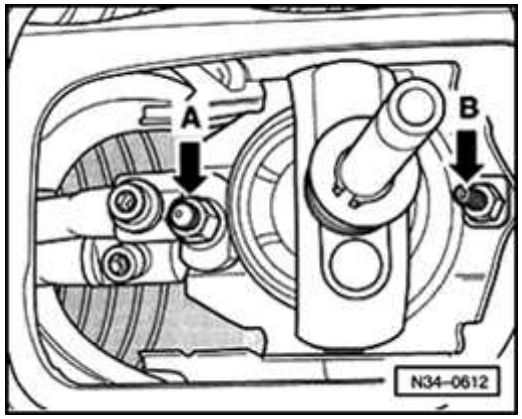


- Loosen bolt for pivot rod (arrow -2-).

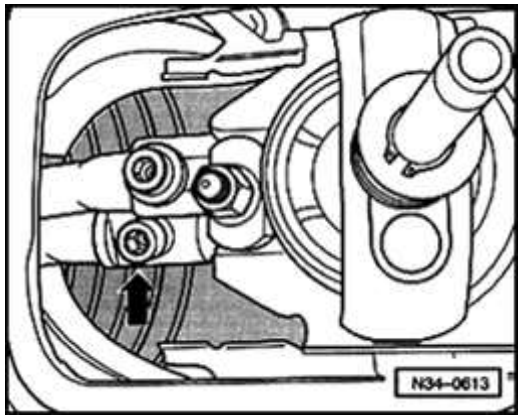
  Rear pivot rod (in shift mechanism) should move freely in both directions on slide.

- Adjust dimension -a- by moving pivot rod (in shift mechanism).
- Tighten pivot rod bolt.

  Tightening torque: 23 Nm (17 ft lb).

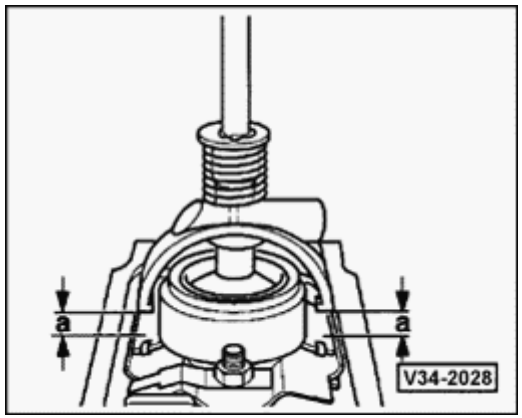


- Loosen ball housing nuts (arrows -A- and -B-).
- Align ball housing horizontally ⇒ Page 34-4 , item 25
- Tighten ball housing nuts (arrows -A- and -B-).
  - Arrow -A-: 25 Nm (18 ft lb)
  - Arrow -B-: 10 Nm (7 ft lb)



- Loosen bolt for shift rod (arrow).

  Connection between shift rod and shift mechanism must move freely.



- Align shift lever so it is positioned slightly toward rear.

➢ Dimension -a- between ball stop buffers and ball housing should be equal on both sides.

- Have second technician hold shift lever.
- Tighten bolt for shift rod.

  Tightening torque: 23 Nm (17 ft lb).

Note:

The position of the shift lever should not change when bolt is tightened.

Shift mechanism adjustment, checking

- Shift lever must rest in 3rd/4th shift gate when transmission is in neutral.

- Operate clutch.

- Make sure all gears can be engaged properly.

- Check operation of reverse gear lock.

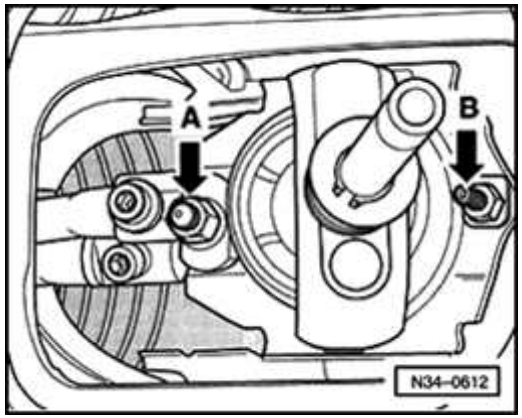
- Move shift mechanism into 5th/reverse gear gate and move in direction of reverse gear (do not push shift lever too hard).

  The movement up to stop reverse gear lock must be 5-10 mm (0.20-0.40 in.) (measured at shift knob).

- Reduce pressure on shift lever, so it can move back.

  Shift lever should return by itself from the 5th/reverse gear gate and move into 3rd/4th gear gate.

- Check fine adjustment if necessary ⇒ Page 34-17 .



Fine adjustment

If shift adjustment is not OK, proceed as follows:

- Loosen nuts for ball housing (arrows -A- and -B-).
- Move shift lever together with ball housing to right toward 5th/reverse gear gate up to stop in transmission and hold in position.
- Press ball housing to left against shift lever.
- Hold shift lever and ball housing in position and tighten ball housing nuts.
  - Arrow -A-: 25 Nm (18 ft lb)
  - Arrow -B-: 10 Nm (7 ft lb)
- Install covers and shift knob.

Note:

If only 5th gear and reverse gear cannot be engaged, the 5th and reverse gear lock must be checked and replaced if necessary ⇒ *Page 34-69* .

34-1

Shift linkage, servicing

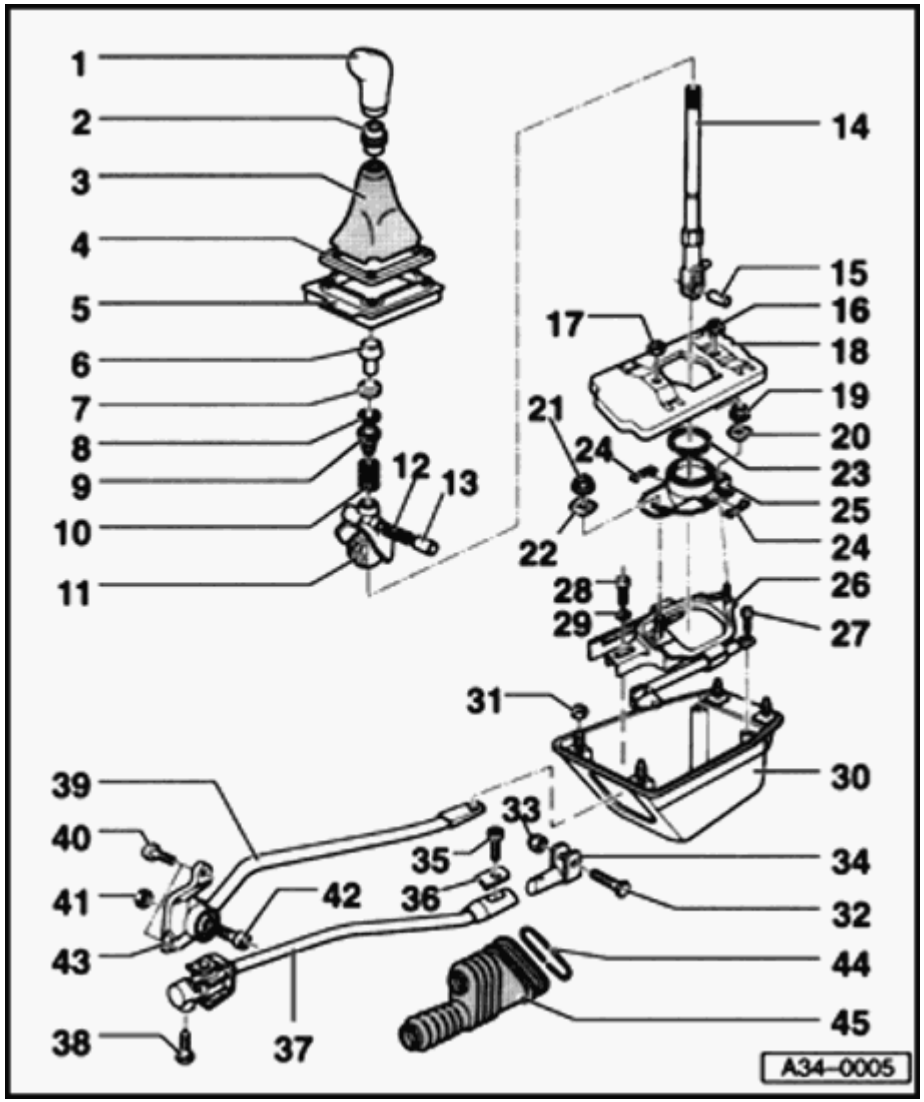
Notes:

- *Adjusting* ⇒ *Page 34-12* .
- *To remove the complete shift linkage, remove the exhaust system.*

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- *To disassemble the shift linkage in the installation position, the shift mechanism housing must be lowered.*

34-2



1 - Shift knob

2 - Bushing

3 - Housing cover

- Carefully pry out latch in rear section of center console

4 - Top part of retaining frame

5 - Bottom part of retaining frame

6 - Bushing

7 - Sleeve

8 - Circlip

- Do not over-stretch when installing

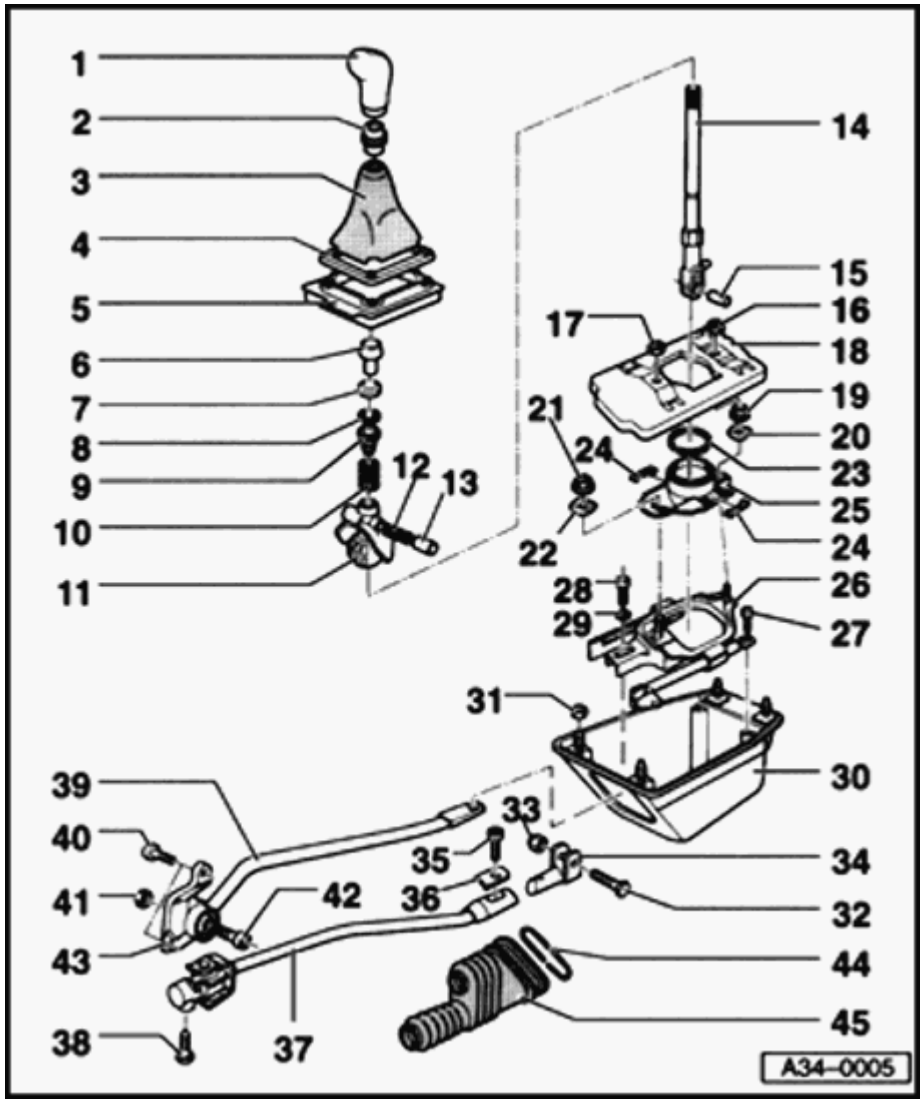
9 - Spacer bushing

10 - Compression spring

11 - Ball stop

- Insert compression spring and bushing into the ball stop and assemble on shift mechanism so that compression spring and bushing are on right (direction of travel)
- Install circlip (item - 23 -) before installing

34-3



12 - Compression spring

13 - Bushing

- Rounded side faces shift lever

14 - Shift lever

- Can be installed into ball housing in one position only

15 - Spacer tube

16 - Nut

- 8 Nm (71 in. lb)

17 - Nut

- 8 Nm (71 in. lb)

18 - Cover

19 - Nut

- 10 Nm (7 ft lb)

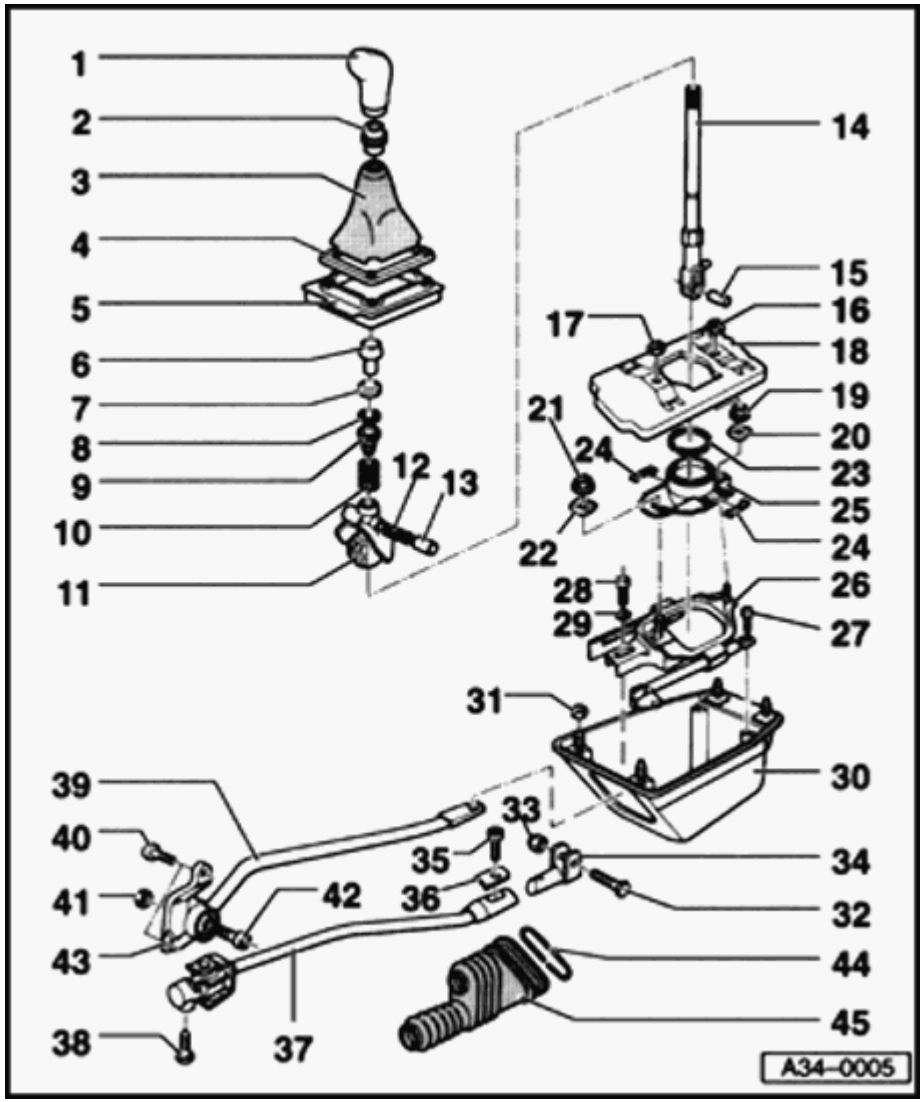
20 - Connecting piece

21 - Nut

- 23 Nm (17 ft lb)

22 - Connecting piece

34-4



23 - Circlip

- Always replace
- Remove before removing ball stop
- Rounded side faces ball housing (item - 25 -)

24 - Buffer

25 - Ball housing

- Buffers for ball stop on left and right must be in place
- Insert so that shift detent for reverse gear faces toward left

26 - Rear shift rod

27 - Bolt

- 10 Nm (7 ft lb)

28 - Bolt

- 23 Nm (17 ft lb)

29 - Washer

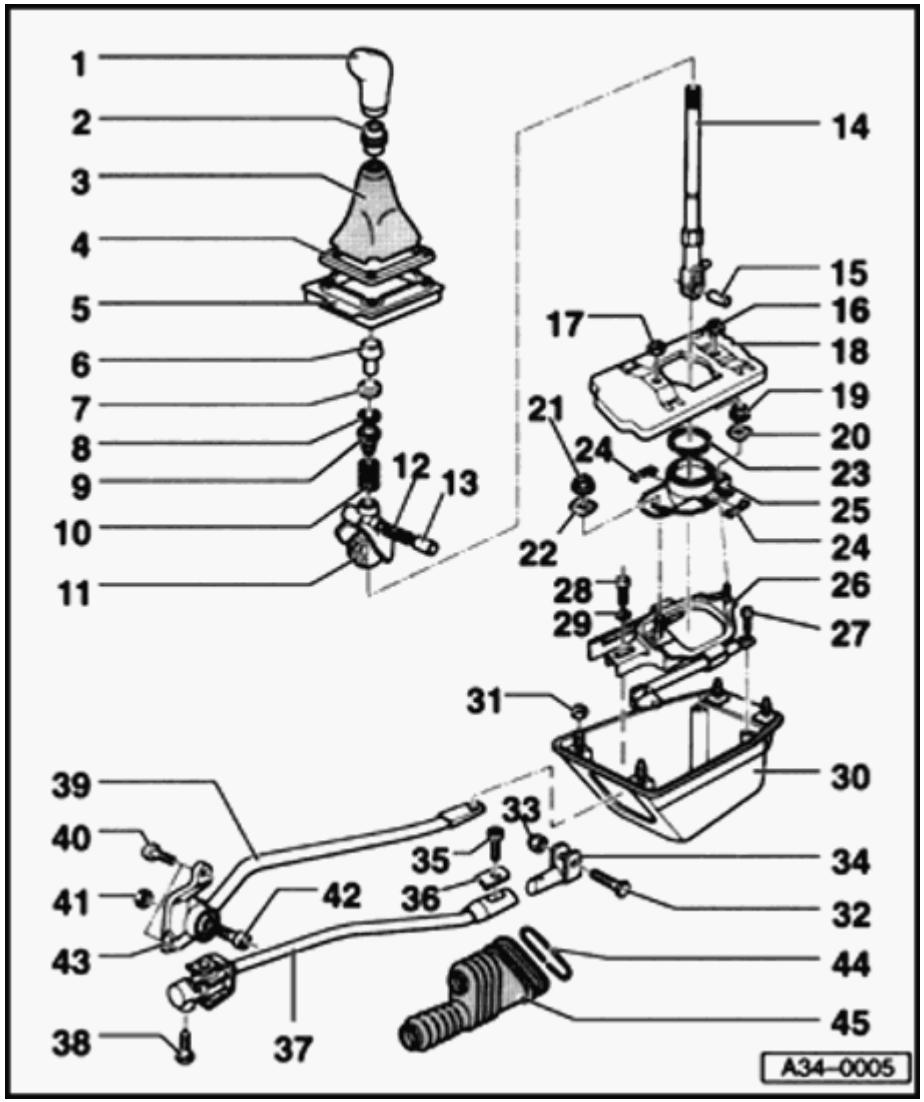
30 - Shift mechanism housing

31 - Nut

- 10 Nm (7 ft lb)

32 - Bolt

34-5



33 - Nut

- Always replace
- 10 Nm (7 ft lb)
- Self locking

34 - Shift fork

35 - Bolt

- 23 Nm (17 ft lb)

36 - Clamp

37 - Shift rod

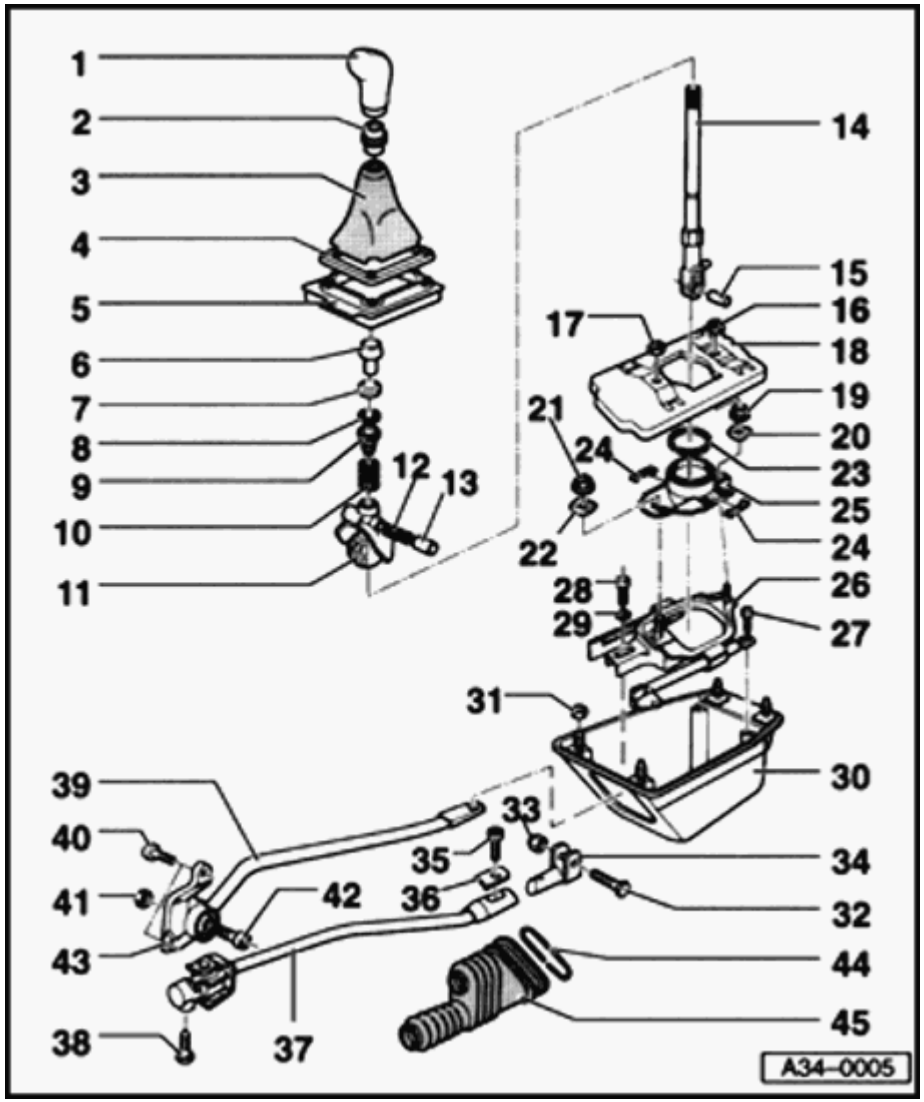
- With shift coupling

38 - Bolt

- Always replace
- 23 Nm (17 ft lb)
- Self locking

39 - Pivot rod

- Avoid tension by first connecting pivot rod to shift mechanism housing and rear shift rod
- Hold bolt (item -42-) in place when tightening nut (item -41-)
- Pivot rod, fastening 06.96 ⇒ Fig. 1



40 - Bolt

- 40 Nm (30 ft lb)

41 - Nut

- 40 Nm (30 ft lb)

42 - Bolt

43 - 4546Mounting bracket for pivot rod

- Revised after 06.96 ⇒ Fig. 1

44 - Tensioning ring

45 - Boot

- To remove and install, remove Three Way Catalytic Converter (TWC) and heat shield
- Carefully pull over shift rod and pivot rod
- When installing, place on markings of shift rod and pivot rod
- Pivot rod, fastening 06.96 ⇒ Fig. 1

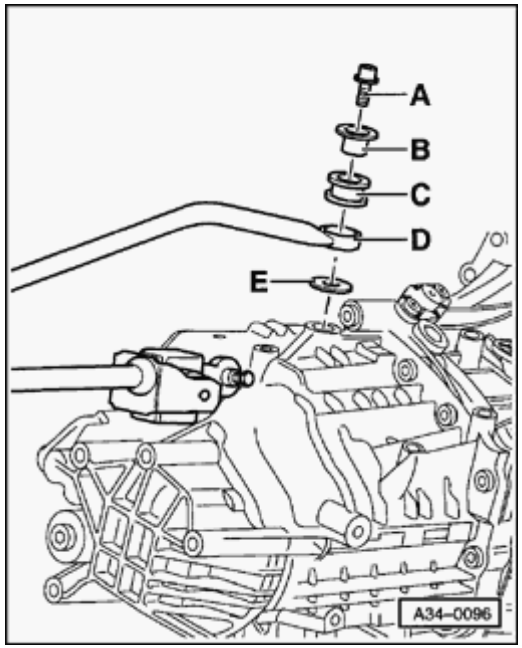


Fig. 1 Pivot rod fastening to transmission 06.96

As of 06.96 the pivot rod is bolted directly to the transmission cover. The additional mounting bracket (item -43-, ⇒ Page 34-6) and its bolts are deleted. For this reason the transmission cover was revised and equipped with an additional mounting point.

A - Socket-head bolt

40 Nm (30 ft lb)

B - Washer

Rounded side faces pivot rod

C - Rubber bushing

D - Pivot rod

E - Washer

Note:

Illustration shows manual transmission 012.

Shift mechanism, removing and installing

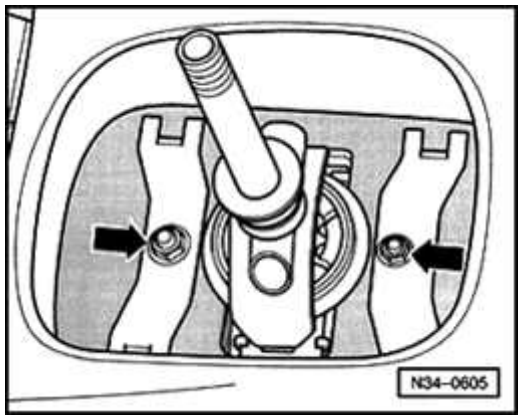
Removing

- Remove shift knob and housing cover.

- Remove center console

  ⇒ *Repair Manual, Body Interior, Repair Group 70*

- Remove cover.



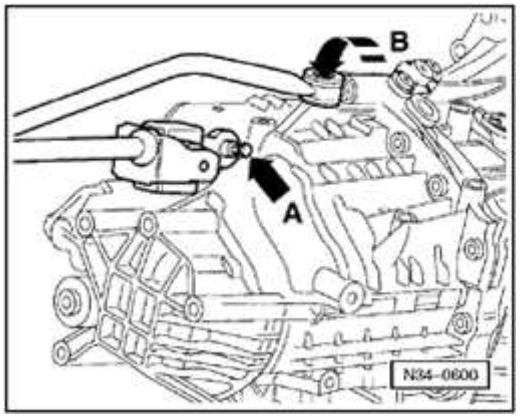
- Remove cover for shift mechanism housing (arrows).

- Remove nuts securing shift mechanism housing (arrows).

- Separate exhaust system behind Three Way Catalytic Converter (TWC), if necessary remove front exhaust system together with Three Way Catalytic Converter (TWC).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Remove driveshaft ⇒ Page 39-71 .



- Remove shift rod (arrow -A-).
- Remove socket-head bolt on pivot rod (arrow -B-).

Note:

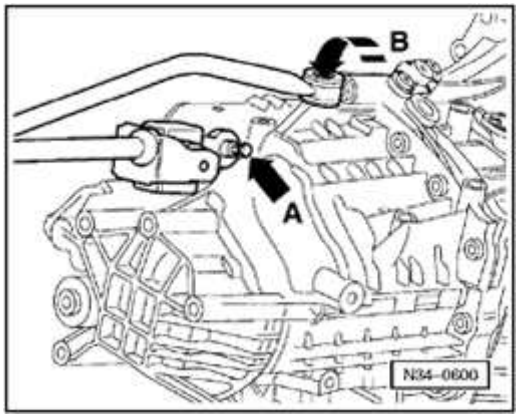
Illustration shows manual transmission 012.

- Swing shift mechanism housing together with shift rod and pivot rod downward and remove.

Installing

Install in reverse order of removal, note the following:

- Push shift rod on so that securing bolt fits into recess of shift rod.



➢

- Secure shift rod (arrow -A-).
- Secure pivot rod to transmission (arrow -B-).
- Adjust shift linkage ⇒ Page 34-12 .
- Install driveshaft ⇒ Page 39-71 .
- Adjust driveshaft ⇒ Page 39-79 .
- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component	Tightening torque
Shift mechanism housing to body	10 Nm (7 ft lb)
Shift rod to transmission	23 Nm (17 ft lb)1)
Pivot rod to transmission	40 Nm (30 ft lb)
1) Always replace bolt	

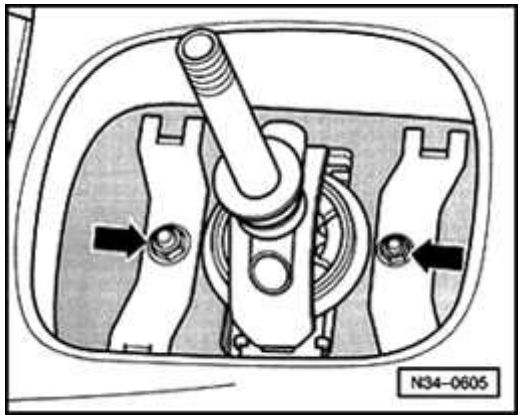
34-12

Shift linkage, adjusting

Requirements

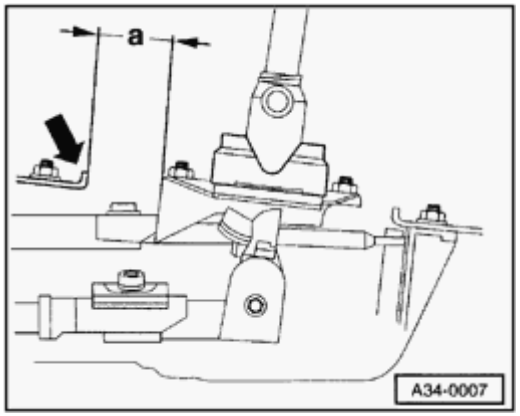
- Components of shift mechanism and linkage must be in proper working condition
- Shift mechanism must move freely
- Transmission, clutch and clutch assembly must be in proper working condition
- Transmission in neutral

- Remove shift knob and housing cover.



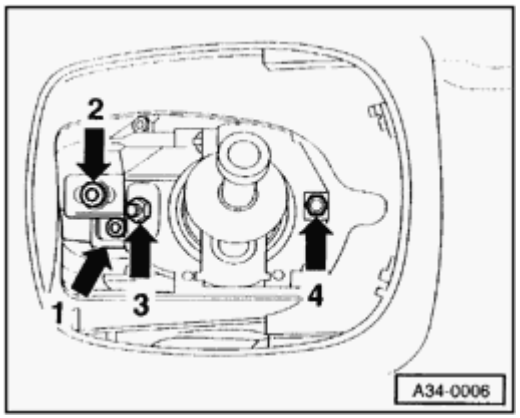
- Remove cover for shift mechanism housing (arrows).

- Measure dimension between body opening and rear shift rod (in shift mechanism).



Dimension -a-: 37 mm (1.456 in.)

If dimension -a- is not attained



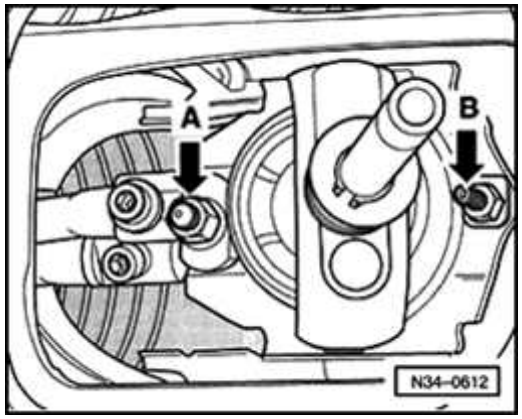
- Loosen bolt for pivot rod (arrow -2-).

  Rear pivot rod (in shift mechanism) should move freely in both directions on slide.

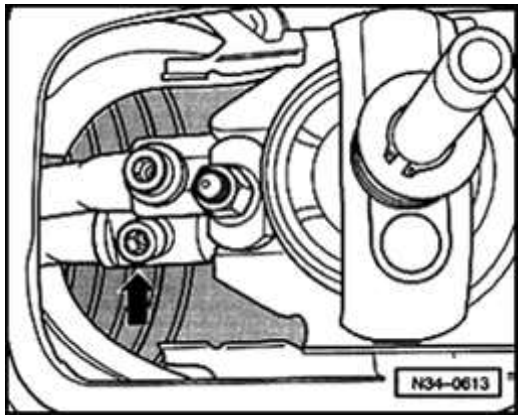
- Adjust dimension -a- by moving pivot rod.

- Tighten pivot rod bolt.

  Tightening torque: 23 Nm (17 ft lb)

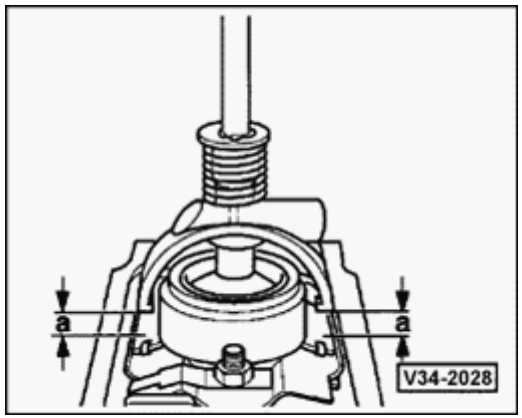


- Loosen ball housing nuts (arrows -A- and -B-).
- Align ball housing horizontally (item 25), ⇒ Page 34-4 .
- Tighten ball housing nuts (arrows -A- and -B-).
  - Arrow -A-: 25 Nm (18 ft lb)
  - Arrow -B-: 10 Nm (7 ft lb)



- Loosen bolt for shift rod (arrow).

  Connection between shift rod and shift mechanism must move freely.



- Align shift lever so it is positioned slightly toward rear.

➢ Dimension -a- between ball stop buffers and ball housing should be equal on both sides.

- Have second technician hold shift lever.
- Tighten bolt for shift rod.

  Tightening torque: 23 Nm (17 ft lb)

Note:

The position of the shift lever should not change when bolt is tightened.

Shift mechanism adjustment, checking

Requirement

- Shift lever must rest in 3rd/4th gear gate when transmission is in neutral.

- Operate clutch.

- Make sure all gears can be engaged properly.

- Check operation of reverse gear lock.

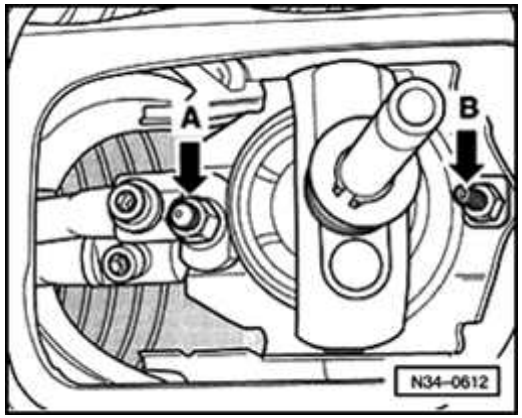
- Move shift mechanism into 5th/reverse-gear gate and move in direction of reverse gear (do not push shift lever too hard).

  The movement up to stop reverse-gear lock must be 5-10 mm (0.196-0.394 in.) (measured at shift knob).

- Reduce pressure on shift lever, so it can move back.

  Shift lever should return by itself from the 5th/reverse gear gate and move into 3rd/4th gear gate.

- Check fine adjustment if necessary ⇒ Page 34-17 .



Fine adjustment

If shift adjustment is not OK, proceed as follows:

- Loosen nuts for ball housing (arrows -A- and -B-).
- Move shift lever together with ball housing to right toward 5th/reverse gear gate up to stop in transmission and hold in position.
- Press ball housing to left against shift lever.
- Hold shift lever and ball housing in position and tighten ball housing nuts.
  - Arrow -A-: 25 Nm (18 ft lb)
  - Arrow -B-: 10 Nm (7 ft lb)
- Install covers and shift knob.

Note:

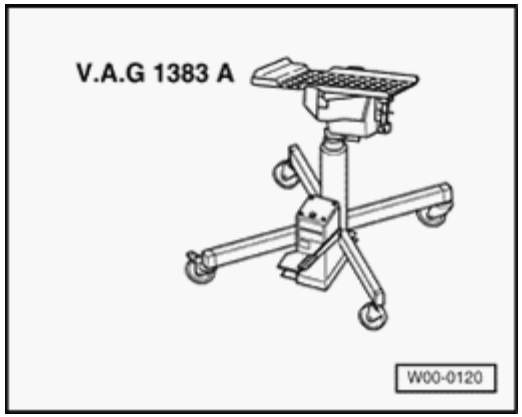
If only 5th gear and reverse gear cannot be engaged, the 5th and reverse gear lock must be checked and replaced if necessary ⇒ *Page 34-86* .

34-18

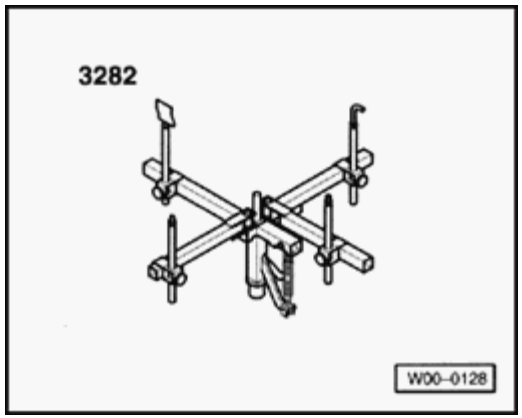
Transmission, removing and installing

Removing

Special tools, testers and auxiliary items required:

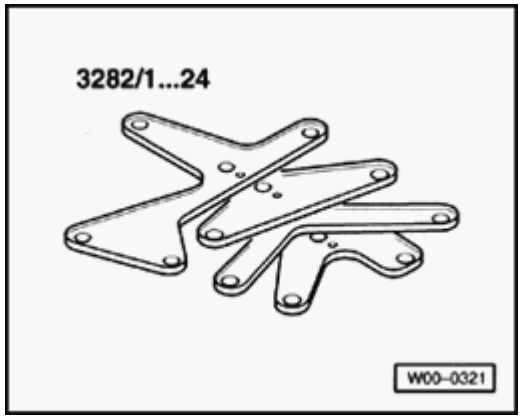


- Engine-/Transmission lifter V.A.G 1383 A



- Transmission support 3282

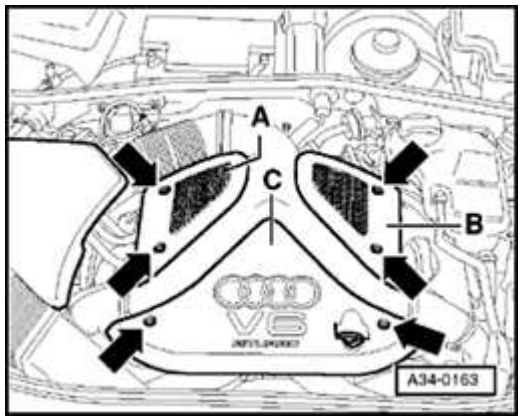
34-19



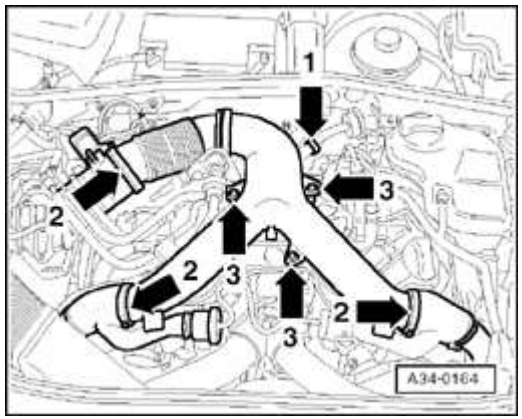
- 3282/12 Adjustment plate
- VAG1306 Drip tray

- Obtain radio code on vehicles with coded radio.

- With ignition switched off disconnect battery Ground strap.



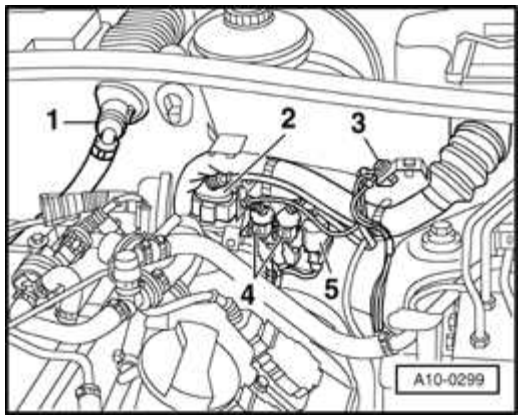
- Loosen bolts (arrows) and remove engine cover panels (arrows -A- through -C-).



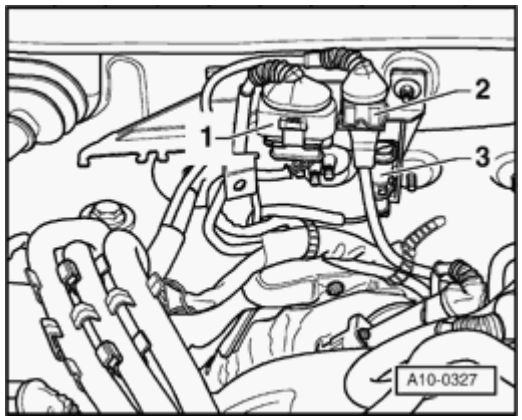
- Detach air intake duct. To do this, pull off retainer catch -1-, loosen clamps -2- and unscrew bolts -3-.

34-21

- Remove coolant system expansion reservoir and lay to one side.

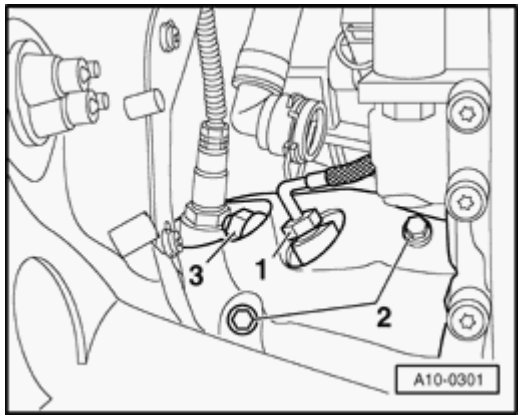


- Unplug connector for oxygen sensor on left (arrow -2-) and move wire for oxygen sensor clear.

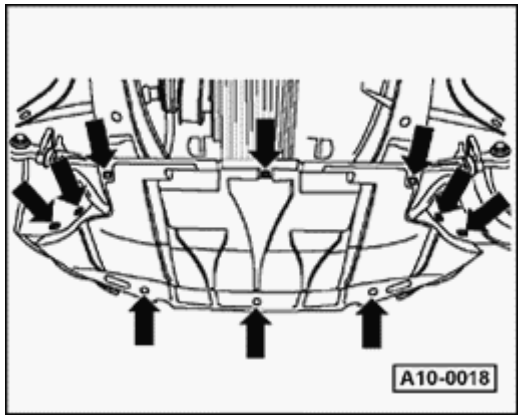


- Unplug connector for oxygen sensor on right -1- and move wire for oxygen sensor clear.

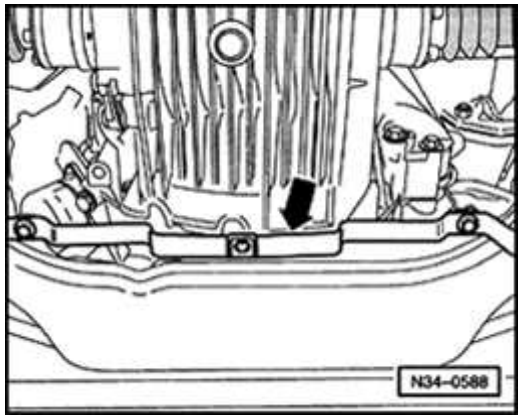
34-22



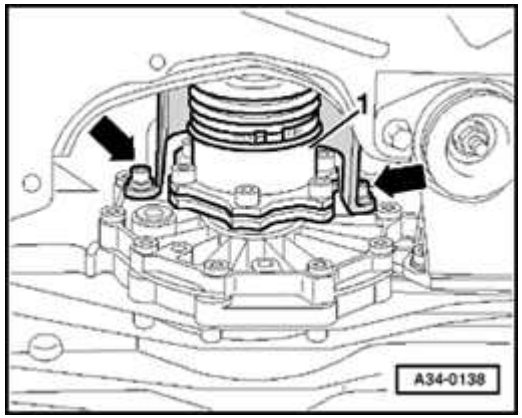
- Unscrew two bolts securing heat shield -2- on exhaust pipe (right and left).
- Unscrew nuts -3- on exhaust pipe (right and left).
- Unscrew engine/transmission securing bolts accessible from above.



- Remove noise insulation (arrows).



- Unbolt bracket for noise insulation (arrow).

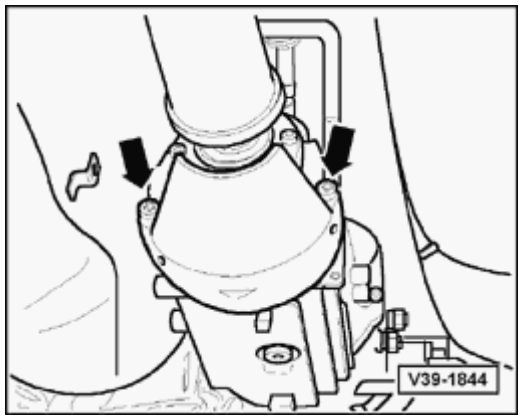


- Unbolt heat shields from transmission above left and right drive axles (arrows).
- Unbolt left and right drive axles -1- from transmission, lift clear and tie in position.

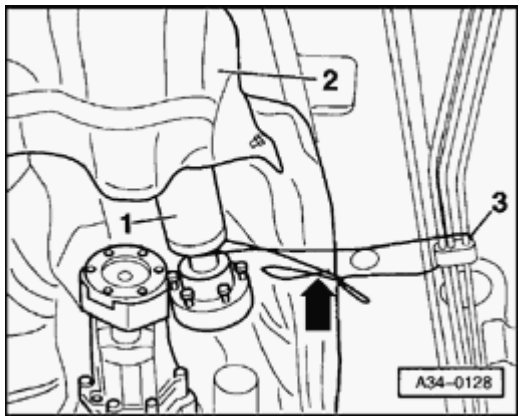
Note:

Take care not to damage protective coating on drive axles.

- Loosen exhaust system clamps and push clamps towards rear.

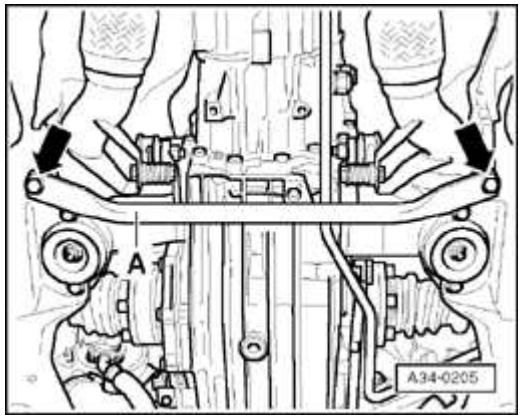


- Remove heat shield for driveshaft from cover for Torsen differential (arrows).

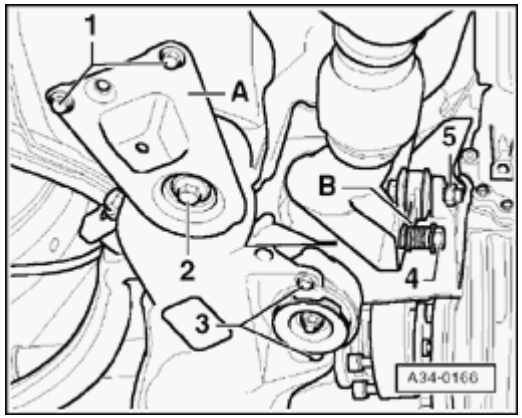


- Unbolt driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel pipe bracket -3- with wire (arrow).

34-25

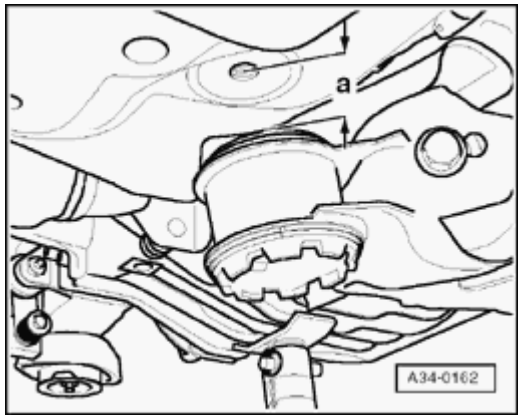


- Remove bolts (arrows) and remove transverse mount -A-.
- Completely remove brackets -B- at right and left exhaust pipe. To do this, bolts -2- and -3- must be removed.



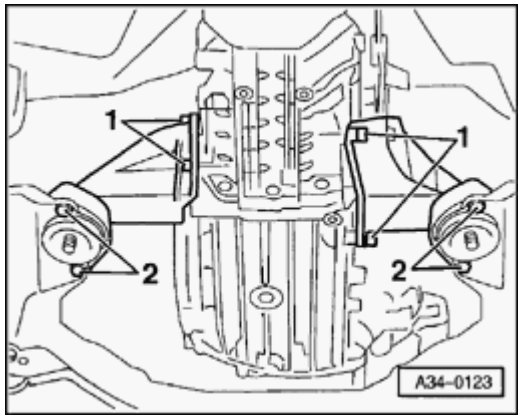
- Unscrew and remove bolts -1- and -2- on right and left and remove support -A-.

34-26



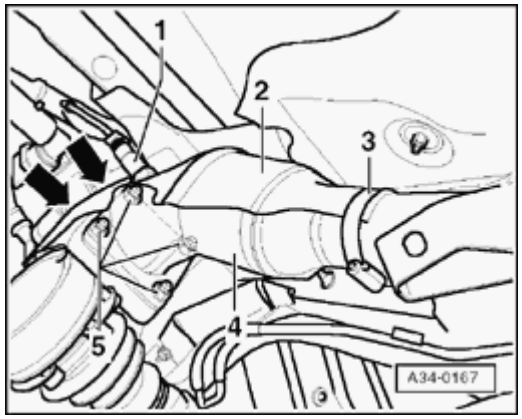
- Lower subframe at rear and place spacer (e.g. wedge of wood) in gap.

♦ -a- = max. 50 mm



- Unscrew bolts -1- and -2- and remove right and left transmission supports from transmission and subframe together with bonded rubber mountings.

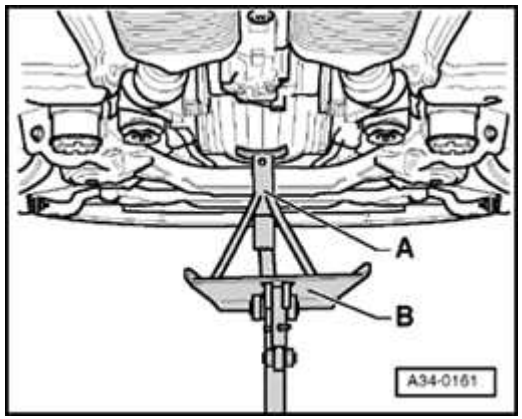
34-27



- Loosen clamp -3-, lift heat shield -2- slightly and unscrew remaining nuts -5-.
- Lift heat shield -2- and pull out front exhaust pipe together with catalytic converter -4-.
- Note that oxygen sensor -1- and oxygen sensor wire have to be guided through opening in heat shield -2-.

Note:

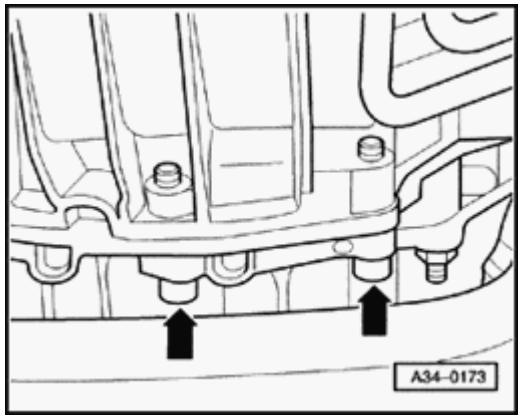
Avoid excessive bending of the flexible pipe connection (decoupling element) on the front exhaust pipe. The angle between the catalytic converter and the front exhaust pipe must not exceed 10 °, otherwise the flexible connection will be damaged.



- Lift the transmission for access to the two lower bolts securing engine to transmission (⇒ A34-0173 below).

A - Axle stand

B - V.A.G 1383A

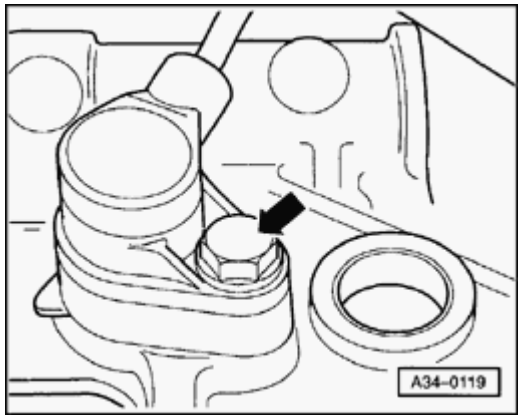


- Unscrew two bolts securing transmission to engine (arrows).

Note:

The two hex socket head bolts M 10 x 60 must be replaced by new hex bolts M 10 x 55 (Part No. N 104 684 01) so that the two bolts (arrows) can be tightened with a torque wrench after installing the transmission.

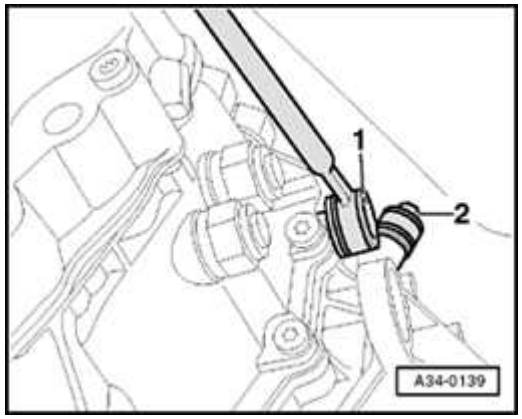
- Lower transmission again slowly.



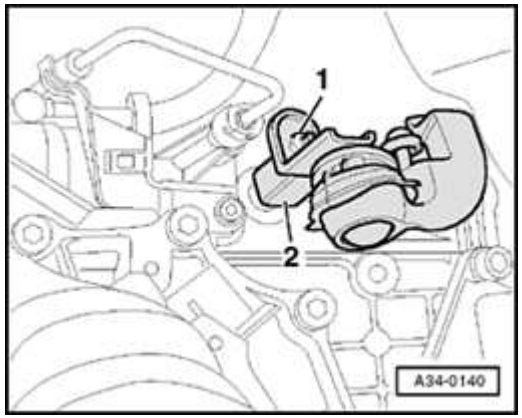
- Remove engine speed sender -G28 from left-hand side of transmission (arrow) and place to one side.
- Pull connector off sender for speedometer.
- Pull off connector on reversing light switch.
- Unbolt the starter and push it as far as it will go towards the front.

Note:

Do not disconnect cables at starter.

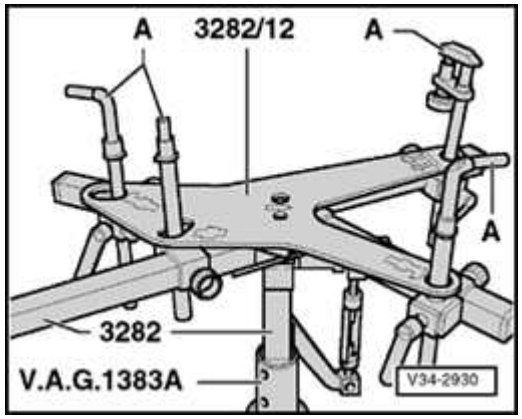


- Unbolt connecting rod -2- for selector rod on right-hand side of transmission.
- Remove hex socket head bolt from push rod -1-.



- Unscrew nut -1- and pull selector rod lever -2- off transmission selector shaft.

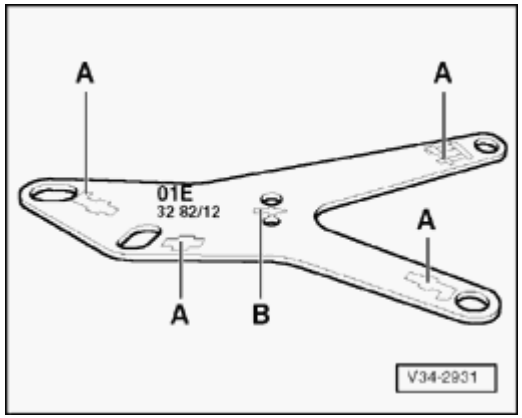
34-30



- Set up transmission support 3282 with adjustment plate 3282/12 for removal of manual transmission 01E (all-wheel drive) and place on transmission jack V.A.G 1383 A.

A - Attachments

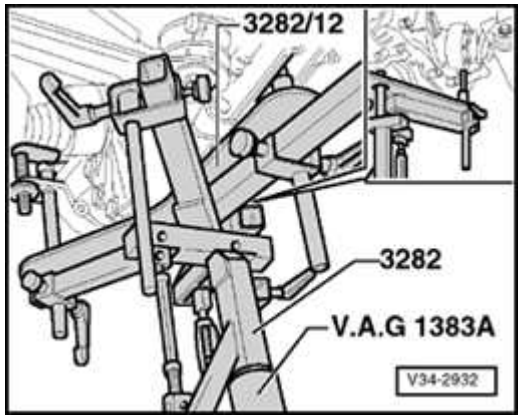
Notes:



- *The positions for the attachments are indicated by symbols (-A-). Arrow -B- points in the direction of travel.*
- *Adjustment plate 3282/12 can only be installed in one position.*

34-31

- Remove all but one of the engine/transmission securing bolts from below (one bolt is left in place to hold engine and transmission together).



- Run transmission jack V.A.G 1383 A with transmission support 3282 in under transmission and take up weight of transmission.
- Secure transmission to transmission support 3282.

Note:

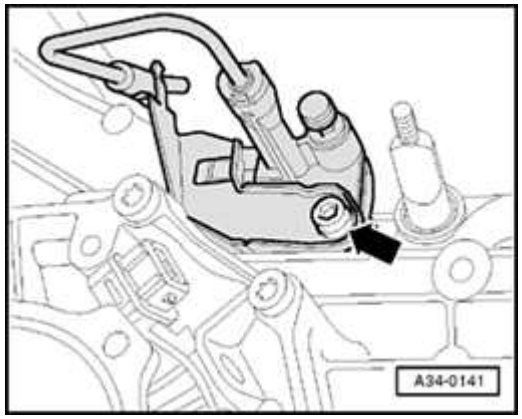
If transmission support 3282 is not available, the transmission can be removed and installed using transmission jack V.A.G 1383 A.

- Remove last remaining engine/transmission securing bolt.
- Press transmission off dowel sleeves and lower carefully with transmission jack V.A.G 1383 A just far enough for access to slave cylinder.

Note:

When lowering transmission ensure hydraulic line/hose to slave cylinder is not damaged.

34-32



- Remove bolt (arrow) and take out slave cylinder from the rear. Do not open line/hose system.

Note:

Do not depress clutch pedal after removing slave cylinder.

- Lower transmission completely.

Note:

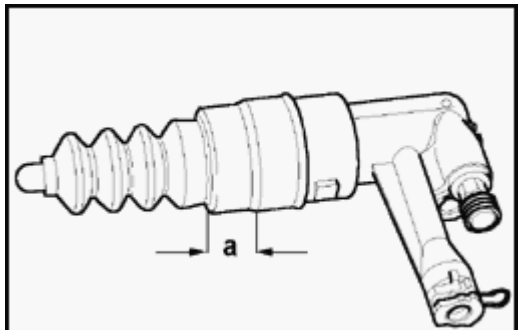
When lowering transmission ensure there is sufficient clearance to drive axles.

34-33

Installing

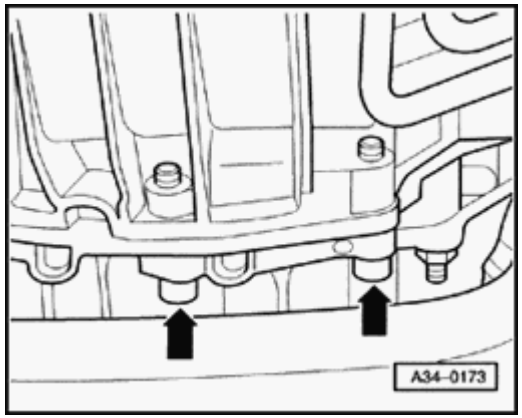
Installation is carried out in the reverse order, when doing this note the following:

- Always replace all seals and gaskets.
- Always replace all self-locking nuts.
- Check whether dowel sleeves for aligning transmission with engine are in engine flange. Insert if necessary ⇒ Page 34-36 .
- Clean input shaft splines and (in the case of used clutch plates) hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to splines. Do not grease guide sleeve.
- Check clutch release bearing for wear and replace if necessary.

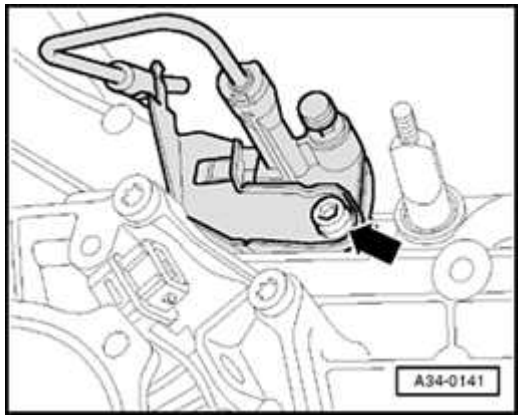


- Coat area -a- of collar with lithium grease G 052 150 A2 before mounting slave cylinder into transmission housing.
- Coat contact surface for clutch slave cylinder push rod with a thin layer of copper grease, e.g. Z381 351 TE.

- On vehicle with V6 bi-turbo engine, fit intermediate plate on dowel sleeves on engine flange.



- Two hex socket head bolts M 10 x 60 must be replaced by new hex bolts M 10 x 55 (Part No. N 104 684 01) so that two bolts (arrows) can be tightened with a torque wrench after installing transmission.
- Before installing transmission, tie electrical wiring off to one side so that it cannot be trapped between engine and transmission.



- Lift transmission until clutch slave cylinder with bracket for line/hose can be installed (arrow).
- Align exhaust system free of stress.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Before installing, use a tap to clean threads in drive flange for driveshaft on transmission to remove traces of locking compound.
- Replace gaskets on drive axles and on front of driveshaft ⇒ Page 39-65 .

- Bolt on driveshaft ⇒ Page 39-71 .

- Check adjustment of selector rod and push rod; readjust if necessary ⇒ Page 34-12 .

- Check oil level in transmission ⇒ Page 34-39 .

- After connecting battery, enter anti-theft code for radio

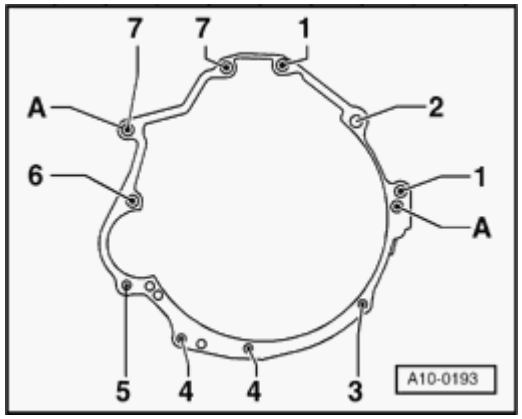
⇒ *Radio operating instructions*

- Close windows fully using electric window switches.

- Operate all electric window switches again for at least one second in "close" direction to activate automatic one-touch function.

- Set clock to correct time.

34-36



Vehicles with 6-cyl. bi-turbo engine

No.	Bolt	Qty.	Nm
1	M 12 x 90	2	65
2	M 12 x 100	1	65
3	M 10 x 60	1	45
4	M 10 x 60 1)	2	45
5	M 10 x 150	1	65
6	M 12 x 130	1	65
7	M 12 x 80	2	65

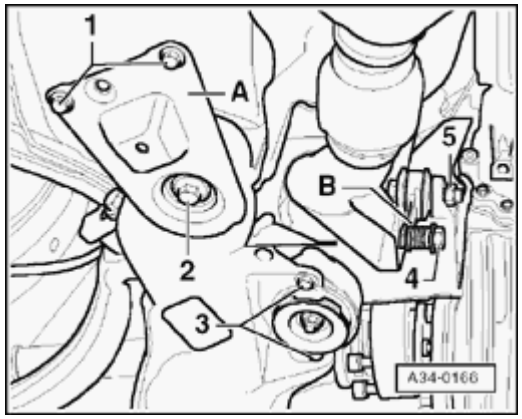
Dowel sleeves -A- for aligning.

1) The two hex socket head bolts M 10 x 60 must be replaced by new hex bolts M 10 x 55 (Part No. N 104 684 01) so that the two bolts -4- can be tightened with a torque wrench after installing the transmission.

Component		Nm
Clutch slave cylinder to transmission [1)]		20
Transmission support to transmission		40
Engine speed sender -G28-		10
Drive axle to drive flange	M8	40
	M10	80
Heat shields above drive axles to transmission		25
Push rod to transmission		40
Selector rod to transmission		23
Connecting rod for selector rod to transmission		23
Catalytic converter to mounting lugs		25
Front exhaust pipe to turbocharger		30
Heat shield to turbocharger/exhaust pipe		10
Clamp for exhaust pipe		40
Bracket for noise insulation to subframe		10
Driveshaft to transmission [1)]		55
Heat shield for driveshaft to Torsen differential cover		25

[1)] Always replace bolts

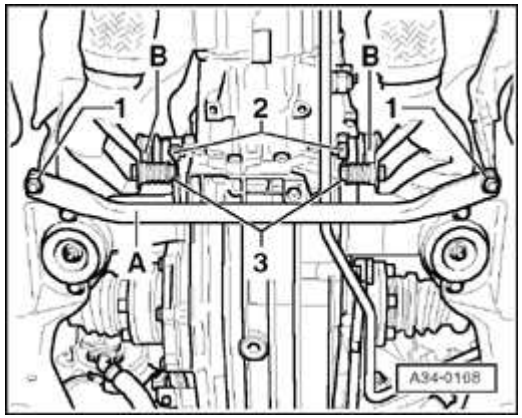
34-38



Subframe to body

Support -A- to body -arrow 1-	75
Subframe to body 1) (arrow -2-)	115 + 90 °
Transmission mounting to subframe (arrow -3-)	25

1) Always replace bolts washers



For 6-cylinder bi-turbo engine only

Cross-piece -A- to subframe 1)	40 + 90 °

1) Install bolts -1- from the bottom. Always replace nuts and bolts.

Transmission, removing and installing

Removing

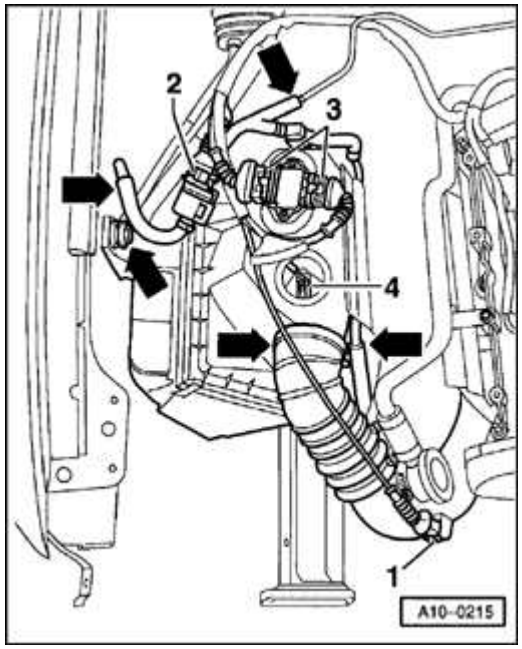
Special tools and equipment

- 3282 transmission support
- 3282/10 adjustment plate
- 3337 ring spanner 7-piece set
- VAG1383A engine/transmission hoist

Notes:

- *Determine the correct coding for the anti-theft radio (if equipped).*
- *Switch the ignition off and disconnect battery Ground (GND) strap.*

Vehicles with 1.8T four-cylinder engine



- Disconnect wires/and harness connectors as follows:

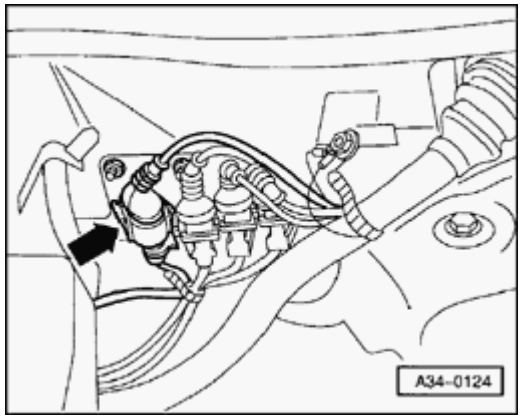
1 - At solenoid valve for wastegate bypass regulator valve -N75-

2 - At Evaporative Emission (EVAP) canister purge regulator valve -N80-

3 - At power output stage -N122-

4 - At Mass Air Flow (MAF) sensor -G70-

- Disconnect hoses and remove air cleaner housing (arrows).
- Remove coolant expansion tank from bracket and lay to side.



- Disconnect harness connector for Heated Oxygen Sensor (HO2S) (arrow) and move wiring clear.
- Remove nuts securing turbocharger to front exhaust pipe.

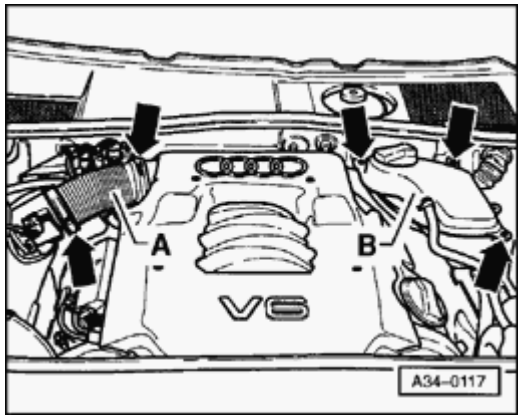
⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

Note:

Do not bend flex pipe on front exhaust pipe more than 10° .

34-20

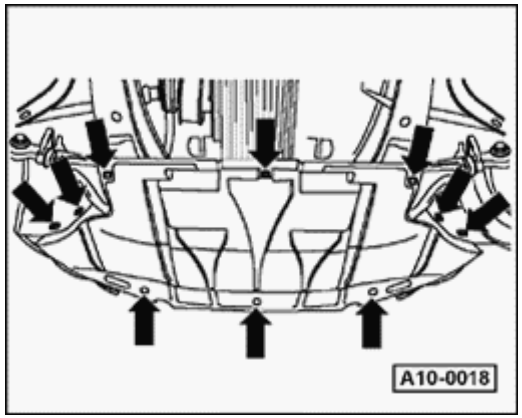
Vehicles with 2.8 liter six-cylinder engine



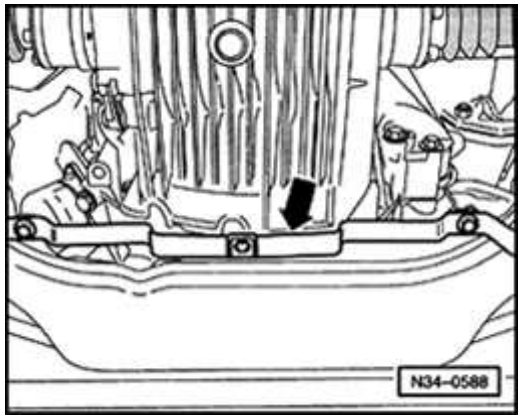
- Remove intake air duct -A- (arrows).
- Unbolt coolant expansion tank -B- (arrows) and lay to one side.
- Remove Heated Oxygen Sensors (HO2S) on left and right exhaust pipes using 3337 ring spanner 7-piece set and move clear to side.

All models

- Remove engine/transmission mounting bolts accessible from above.

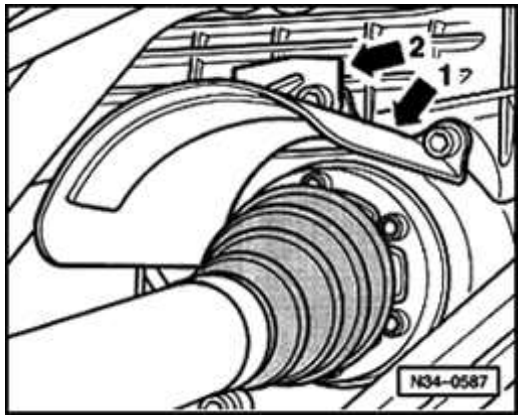


- Remove noise insulation panel (arrows).

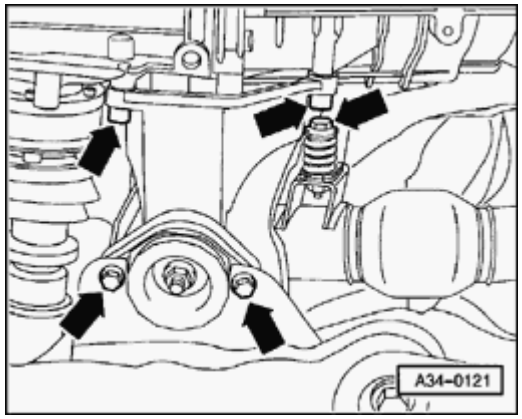


- Remove bracket for noise insulation panel (arrow).

4-cylinder engine



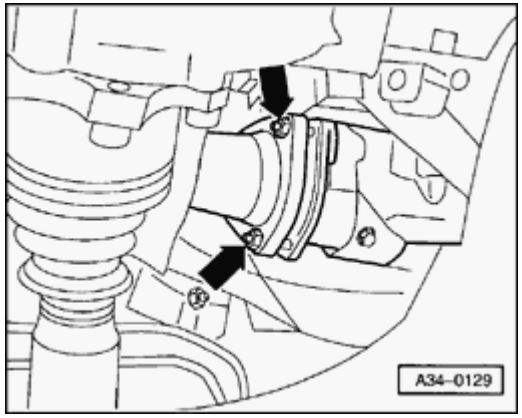
- Remove heat shield (arrows -1- and -2-) above right drive axle.



- Unbolt right transmission support together with bonded rubber mount (arrows).
- Loosen clamping sleeves of exhaust system and slide toward Three Way Catalytic Converter (TWC).
- Remove Three Way Catalytic Converter (TWC) together with exhaust pipe from below.

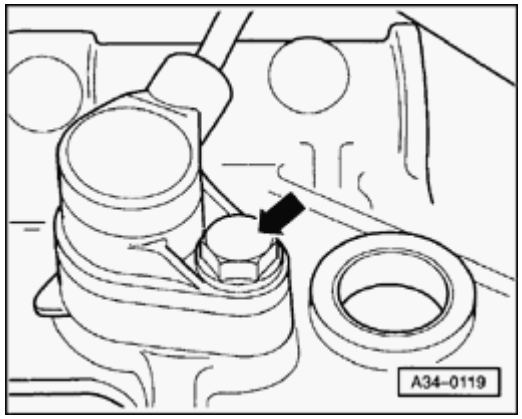
6-cylinder engine

- Remove heat shields above left and right drive axles.



- Unbolt front exhaust pipes together with Three Way Catalytic Converters (TWCs) from left and right exhaust manifolds (3 nuts on each side) (arrows).

⇒ *Repair Manual, Engine Mechanical, Repair Group 26*



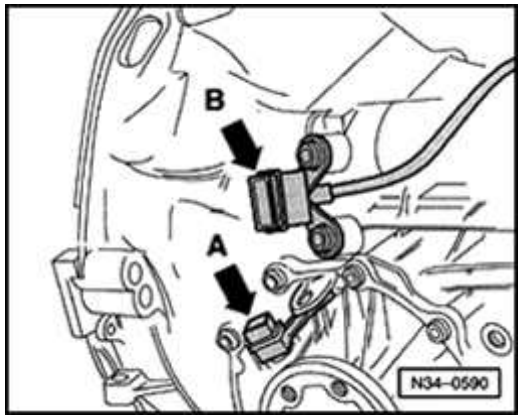
- Remove engine speed (RPM) sensor -G28- on left of transmission (arrow) and move clear to side.

All models

- Disconnect drive axles from flange shafts and rest them on suspension links.

Note:

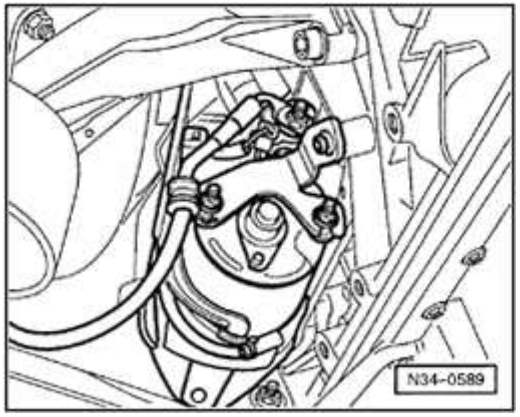
Take care not to damage protective coating on drive axles.



- Disconnect harness connector from Vehicle Speed Sensor (VSS) (arrow -A-).

- Disconnect back-up light harness connector (multi-function switch) (arrow -B-).
- Disconnect all other electrical connections and Ground (GND) wires from transmission and from engine/transmission mounting bolts.

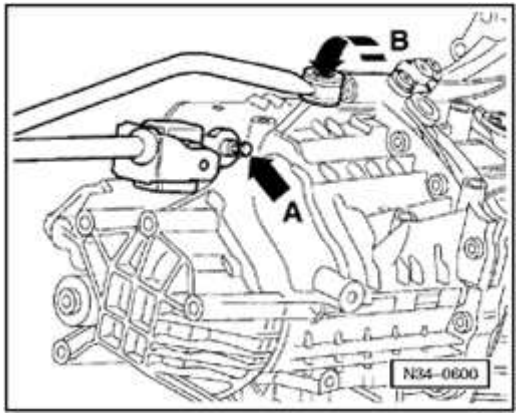
34-24



- Remove starter from engine/transmission and secure if necessary ⇒ *Repair Manual, Electrical Equipment, Repair Group 27* .

Note:

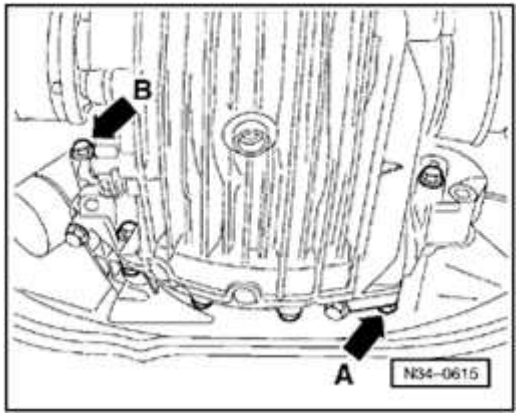
Starter cables do not have to be disconnected.



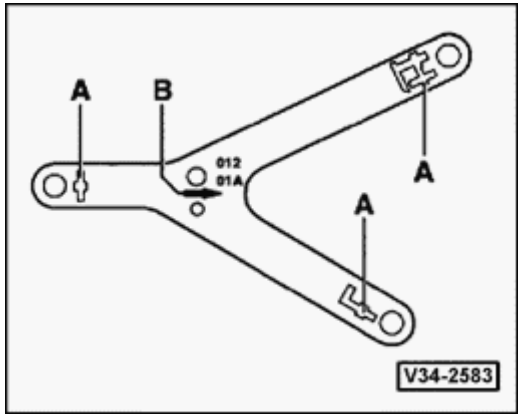
- Disconnect shift rod (arrow -A-).
- Remove socket-head bolt from pivot rod (arrow -B-).

34-25

All models



- Remove bottom engine/transmission mounting bolts, except for bolts indicated by arrows -A- and -B-.



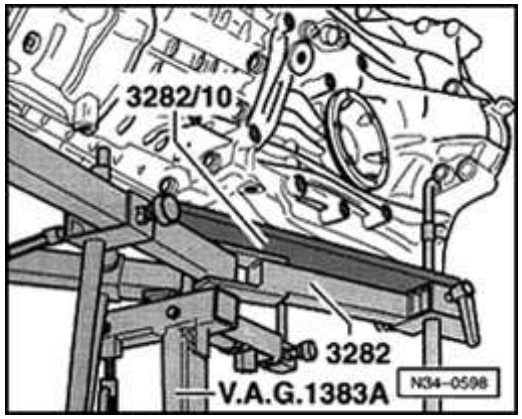
- Set up 3282 transmission support for removing manual transmission 01A (all wheel drive) using 3282/10 adjustment plate and place on VAG1383A transmission jack.

A - Attachments

Notes:

- *Attachments -A- are shown in schematic form.*
- *Arrow -B- points in the direction of travel.*
- *3282/10 adjustment plate only fits in one position.*

34-26

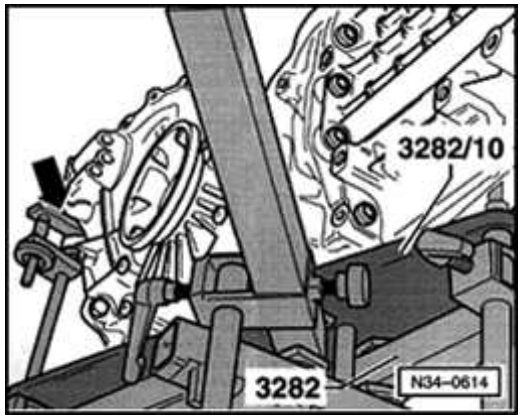


- Roll VAG1383A transmission jack with 3282 transmission support under transmission and support transmission.

Note:

If 3282 transmission support is not available, the transmission can be removed and installed using the VAG1383A transmission jack and the VAG1359/2 universal mount.

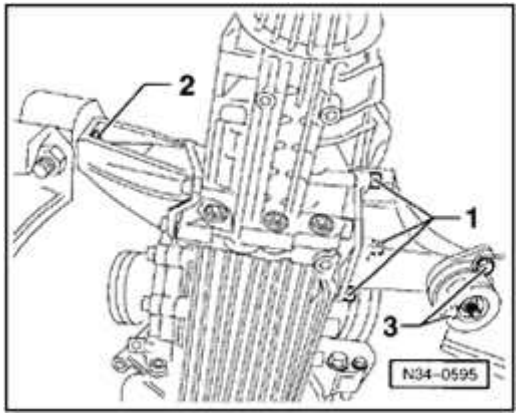
- Support transmission using VAG1383A transmission jack.



- Align adjustment plate parallel to transmission and lock safety support (arrow) on transmission.

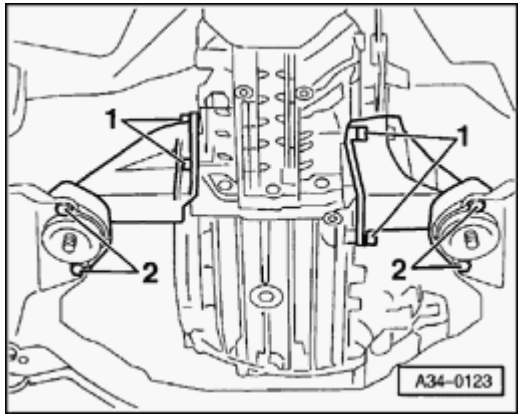
34-27

4-cylinder engine



- Remove left transmission support from bonded rubber mount -2-.

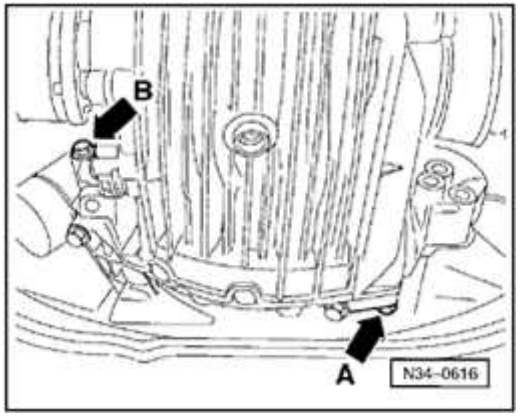
6-cylinder engine



- Remove left and right transmission supports complete with bonded rubber mounts from transmission and subframe -1- and -2-.

34-28

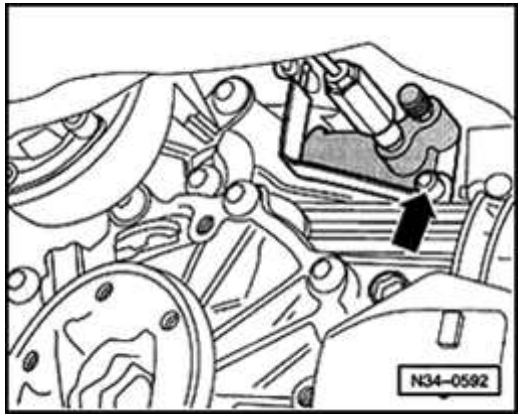
All models



- Remove remaining engine/transmission mounting bolts (arrows -A- and -B-).
- Press transmission off dowel sleeves and lower carefully using VAG1383A transmission jack just far enough for access to slave cylinder.

Note:

When lowering the transmission, make sure the hydraulic line/hose to clutch slave cylinder is not damaged.



- Remove clutch slave cylinder (arrow) and secure using wire; do not disconnect line.

Note:

After removing the clutch slave cylinder, do not operate the clutch pedal.

- Lower transmission completely.

Note:

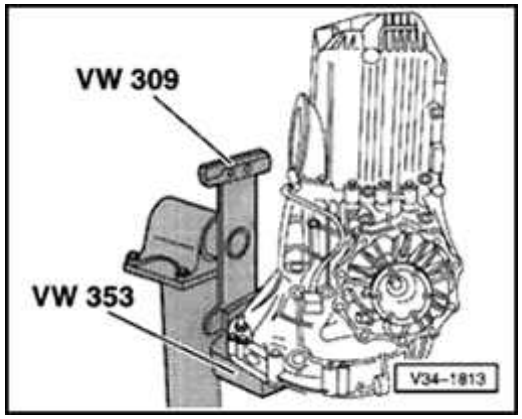
Make sure drive axles have sufficient clearance when lowering transmission.

34-29

Securing transmission to assembly stand

Special tools and equipment

- VW309 holding plate
- VW353 transmission support



- Secure transmission to assembly stand using VW353 transmission support and VW309 holding plate when working on transmission.

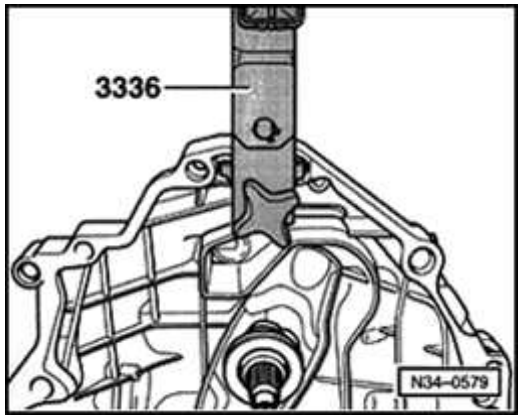
34-30

Transmission, transporting

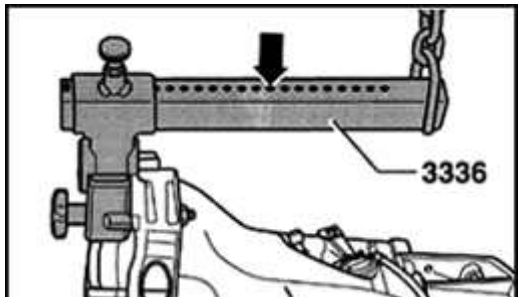
Special tools and equipment

- 3282 transmission support
- 3336 transmission support jig

The transmission support jig can be used when transporting the transmission and for setting up 3282 transmission support.



- Bolt 3336 transmission support jig to transmission housing.



- Adjust support jig on sliding piece using locking pin (arrow).

  Number of visible holes = 17

- Lift transmission using workshop crane and 3336 transmission support jig.

Installing

Installation is the reverse order of removal, note the following:

- Clean input shaft splines and (in case of used clutch plates) hub splines. Remove corrosion and apply only a very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.

- Check throwout bearing for wear and replace if necessary.

- Before installing, coat contact surface of clutch release lever plunger with thin layer of copper grease, e.g. Z 381 351 TE.

- Threaded holes for mounting clutch slave cylinder to transmission and shift lever to shift rod must be cleaned of locking compound residue using threaded tap before installation.

- Make sure centering sleeves for engine to transmission are installed correctly in cylinder block. Install or replace if necessary.

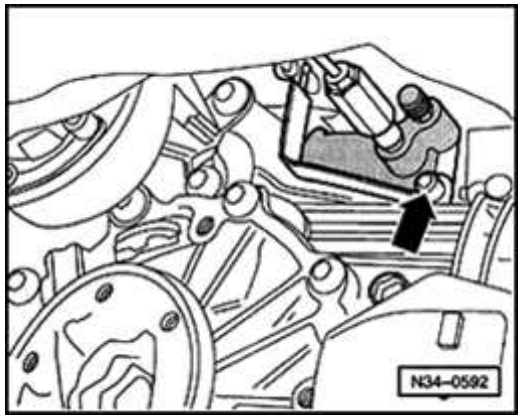
- Always replace self-locking nuts.

- Install engine/transmission intermediate plate (if

present) onto engine centering sleeves.

- Make sure intermediate plate is correctly seated on engine.

34-32



- Lift transmission until clutch slave cylinder with mounting bracket for line/hose can be installed (arrow).
- Install lower engine/transmission and starter mounting bolts and install starter.

⇒ *Repair Manual, Electrical Equipment, Repair Group 27*

- Check adjustment of shift mechanism and adjust if necessary ⇒ Page 34-12 .
- Align exhaust system free of stress.

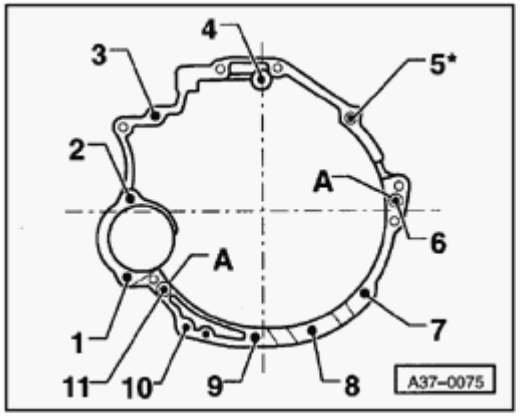
⇒ *Repair Manual, Engine Mechanical, Repair Group 26*

- Check transmission oil level ⇒ Page 34-36 .
- After connecting battery, enter anti-theft code for radio.

⇒ *Radio Operating Manual*

- Fully close power windows to stop.
- Then activate all power window switches ("up") for at least a second to activate automatic window raising/lowering.
- Set clock to correct time.

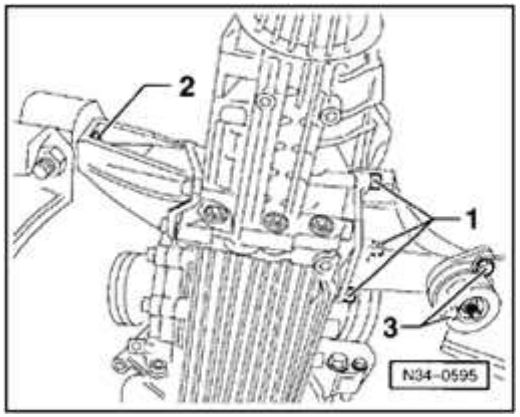
Tightening torques



Transmission to engine (4-cylinder)

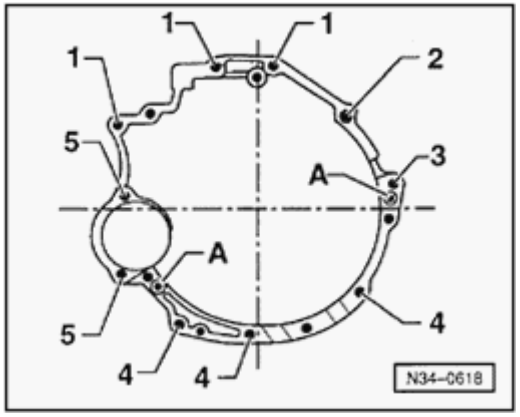
Item No.	Bolt	Tightening torque
1, 3, 4	M12 x 67	65 Nm (48 ft lb)
2, 6	M12 x 90	65 Nm (48 ft lb)
5, 11	M12 x 110	65 Nm (48 ft lb)
7 - 10	M10 x 45	45 Nm (33 ft lb)

A: Dowel sleeves



Transmission/engine assembly mount (4-cylinder)

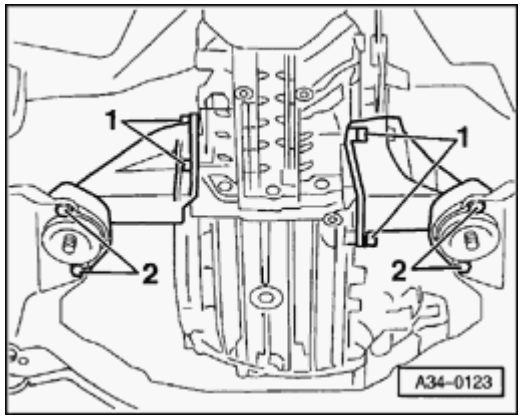
Item No.	Bolt	Qty.	Tightening torque
1	M10 x 30	3	40 Nm (30 ft lb)
2	M10 x 35	1	50 Nm (37 ft lb)
3	M8 x 20	2	23 Nm (17 ft lb)



Transmission to engine (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M12 x 67	3	65 Nm (48 ft lb)
2	M12 x 90	1	65 Nm (48 ft lb)
3	M12 x 80	1	65 Nm (48 ft lb)
4	M10 x 45	3	45 Nm (33 ft lb)
5	M10 x 135	1	45 Nm (33 ft lb)
51)	M12 x 130	1	65 Nm (48 ft lb)
1) Upper starter bolt			

A: Dowel sleeves



Transmission/engine assembly mount (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M10 x 35	3	40 Nm (30 ft lb)
2	M8 x 20	2	23 Nm (17 ft lb)

34-35

Component		Tightening torque
Drive axle to flange shaft	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Engine Speed (RPM) sensor - G28-		10 Nm (7 ft lb)
Clutch slave cylinder to transmission		
	Socket-head bolt 1)	20 Nm (15 ft lb)
	Bolt 2)	25 Nm (18 ft lb)
Heat shields over drive axles to transmission		23 Nm (17 ft lb)
Shift rod to transmission 1)		20 Nm (15 ft lb)
Pivot rod to transmission		40 Nm (30 ft lb)
Three Way Catalytic Converter (TWC) to mounts		25 Nm (18 ft lb)
Front exhaust pipe to turbocharger or exhaust		25 Nm (18 ft lb)

manifold	
Clamp for exhaust pipe	40 Nm (30 ft lb)
Bracket for noise insulation panel to body	10 Nm (7 ft lb)

1) Always replace bolt.

2) Coat with locking fluid D 185 400 A2 before installing.

Transmission, removing and installing

Special tools and equipment

- 3282 transmission support
- 3282/10 adjustment plate
- 3337 ring spanner 7-piece set
- VAG1383A engine/transmission hoist

Removing

CAUTION!

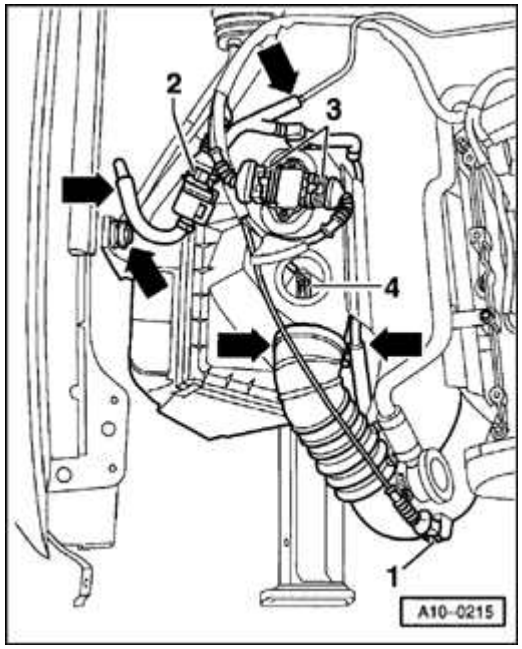
Before disconnecting the battery:

- ***Determine the correct coding for the anti-theft radio.***
- ***Switch the ignition off (also applies when connecting the battery). Failure to do so may damage the Engine Control Module (ECM).***

- Disconnect battery

- Remove driveshaft ⇒ Page 39-71 .

4-cylinder engine



- Disconnect wires/and harness connectors as follows:

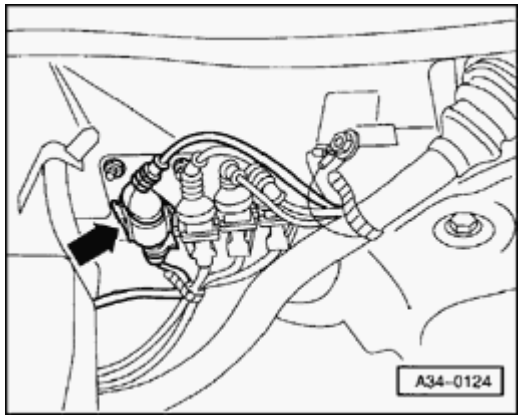
1 - At solenoid valve for wastegate bypass regulator valve -N75-

2 - At Evaporative Emission (EVAP) canister purge regulator valve -N80-

3 - At power output stage -N122-

4 - At Mass Air Flow (MAF) sensor -G70-

- Disconnect hoses and remove air cleaner housing (arrows).
- Remove coolant expansion tank and lay to one side.

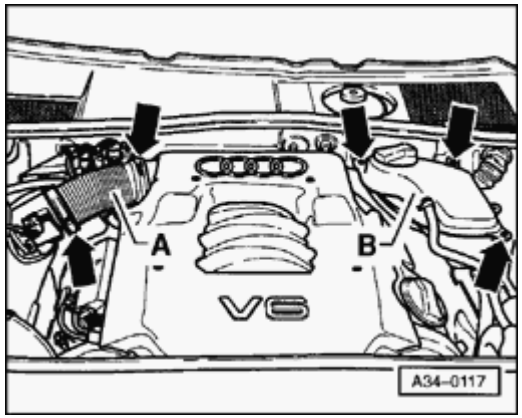


- Remove harness connector for Heated Oxygen Sensor (HO2S) (arrow) and move wiring clear.
- Remove nuts securing turbocharger to front exhaust pipe.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Note:

Do not bend flex pipe on front exhaust pipe more than 10° .

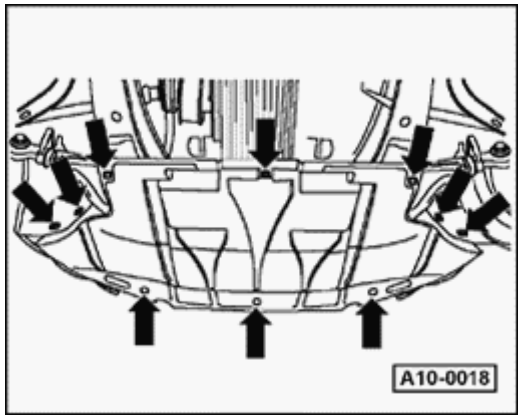


6-cylinder engine

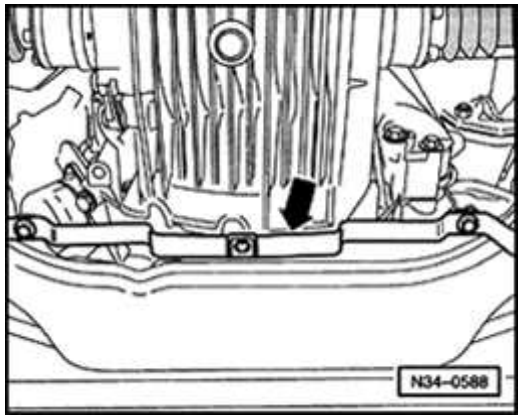
- Remove intake air duct -A- (arrows)
- Unbolt coolant expansion tank -B- (arrows) and lay to one side.
- Remove Heated Oxygen Sensors (HO2S) on left and right exhaust pipes using 3337 ring spanner 7-piece set and move clear to side.

All models

- Remove engine/transmission mounting bolts accessible from above.

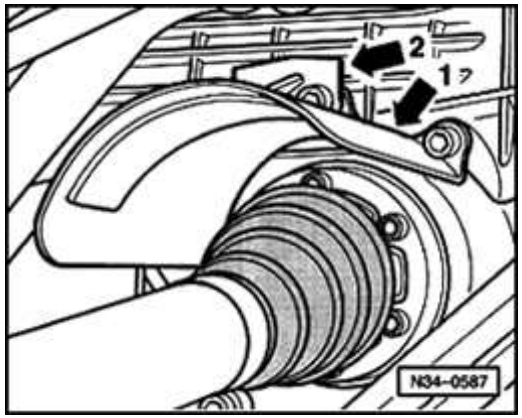


- Remove noise insulation panel (arrows).



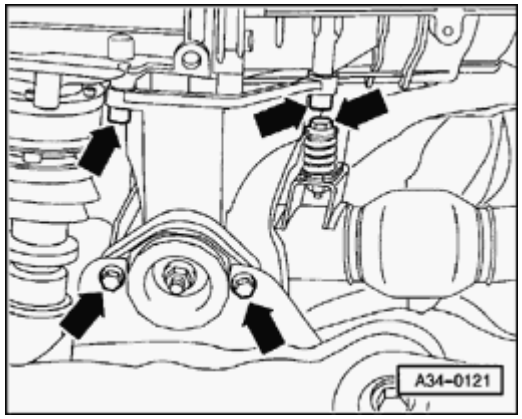
- Remove bracket for noise insulation panel (arrow).

4-cylinder engine



- Remove heat shield (arrows -1- and -2-) above right drive axle.

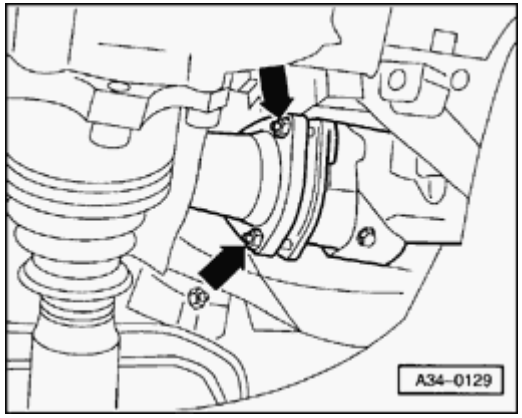
34-22



- Unbolt right transmission support together with bonded rubber mount (arrows).
- Loosen clamping sleeves of exhaust system and slide toward Three Way Catalytic Converter (TWC).
- Remove Three Way Catalytic Converter (TWC) together with exhaust pipe from below.

6-cylinder engine

- Remove heat shields above left and right drive axles.

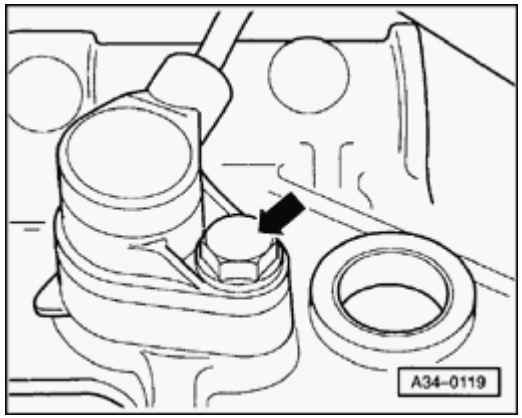


- Unbolt front exhaust pipes together with Three Way Catalytic Converters (TWCs) from left and right exhaust manifolds (3 nuts on each side) (arrows).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

34-23

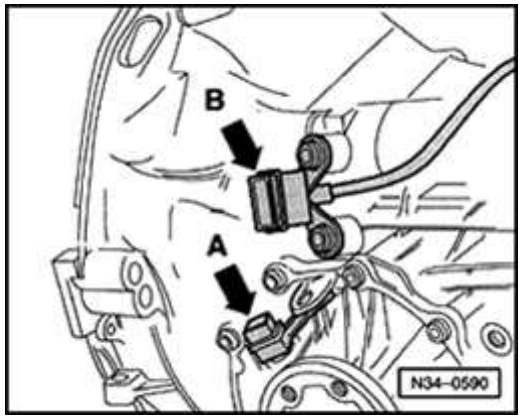
All models



- Remove engine speed (RPM) sensor -G28- on left of transmission (arrow) and move clear to side.
- Disconnect drive axles from flange shafts and rest them on suspension links.

Note:

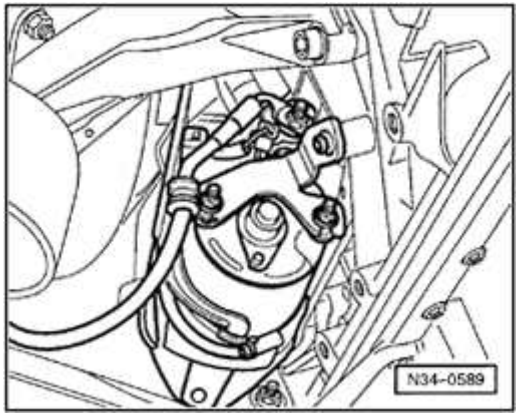
Take care not to damage protective coating on drive axles.



- Disconnect harness connector off Vehicle Speed Sensor -VSS- (arrow -A-).

- Disconnect back-up light connector (multi-function sensor) (arrow -B-).
- Disconnect all other electrical connections and ground wires from transmission and from engine/transmission mounting bolts.

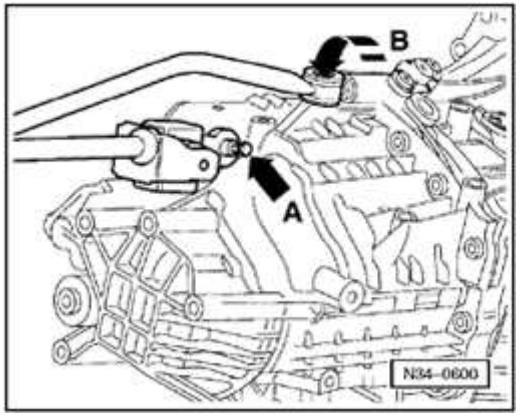
34-24



- Remove starter from engine/transmission and secure if necessary ⇒ *Repair Manual, Electrical Equipment, Repair Group 27*

Notes:

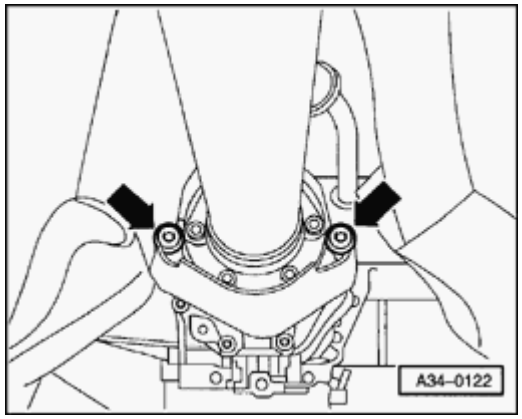
Starter cables do not have to be disconnected.



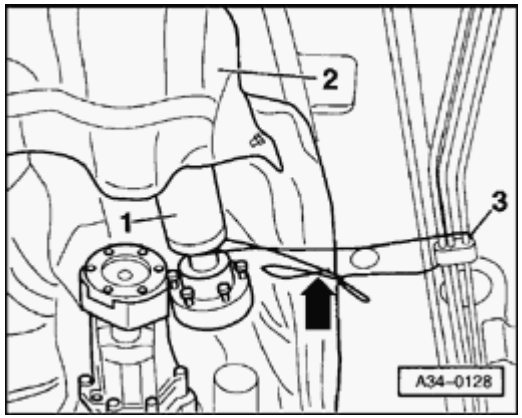
- Disconnect shift rod (arrow -A-).
- Remove socket-head bolt from pivot rod (arrow -B-).

Note:

Illustration shows manual transmission 012.

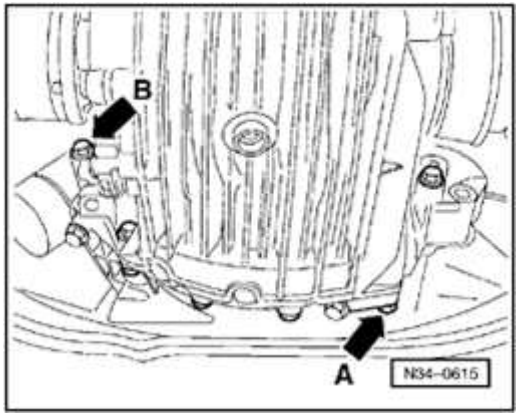


- Remove heat shield for driveshaft from Torsen differential cover (arrows).

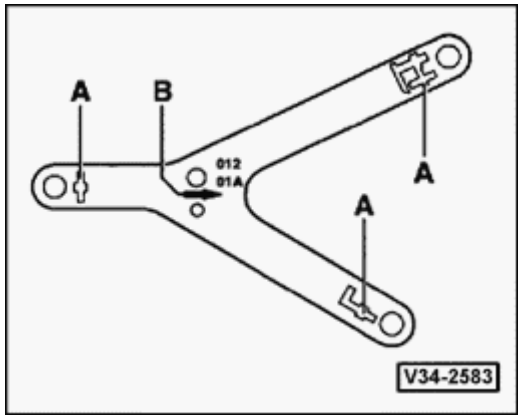


- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrow).

34-26



- Remove bottom engine/transmission mounting bolts, except for bolts indicated by arrows -A- and -B-.



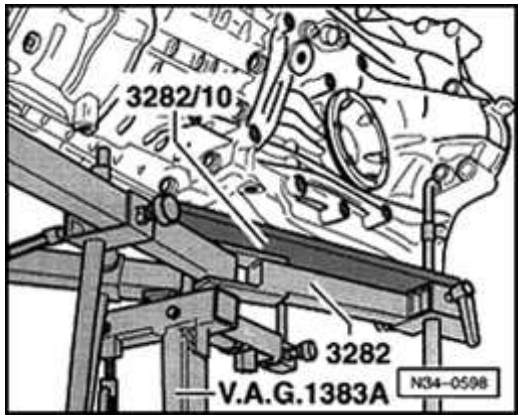
- Set up 3282 transmission support for removing manual transmission 01A (all-wheel-drive) using 3282/10 adjustment plate and place on VAG1383A transmission jack.

A - Attachments

Notes:

- *Attachments -A- are shown in schematic form, arrow -B- points in the direction of travel.*
- *3282/10 adjustment plate only fits in one position.*

34-27

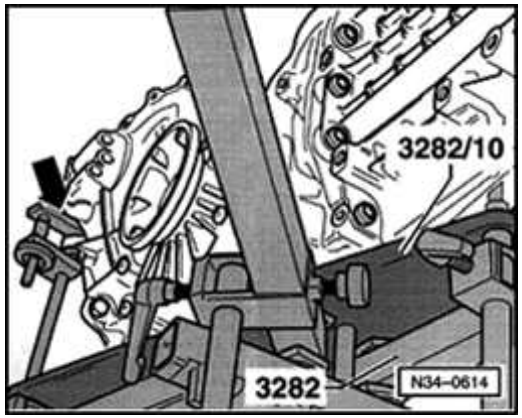


- Roll VAG1383A transmission jack with 3282 transmission support under transmission and support transmission.

Note

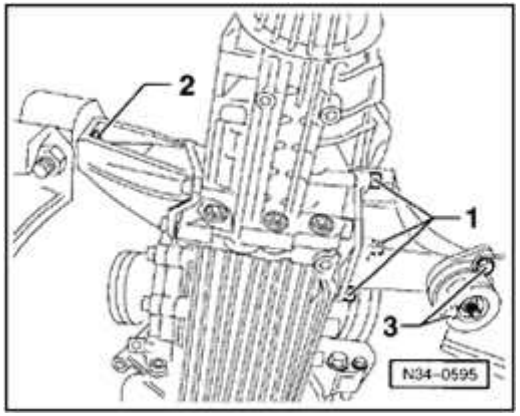
If 3282 transmission support is not available, transmission can be removed and installed using VAG1383A transmission jack and VAG1359/2 universal mount.

- Support transmission using VAG1383A transmission jack.



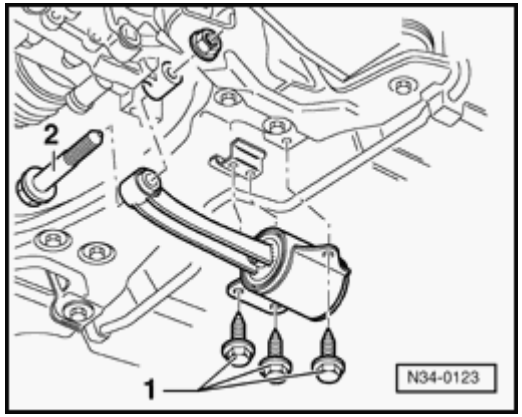
- Align adjustment plate parallel to transmission and lock safety support (arrow) on transmission.

4-cylinder engine



- Remove left transmission support from bonded rubber mount -2-.

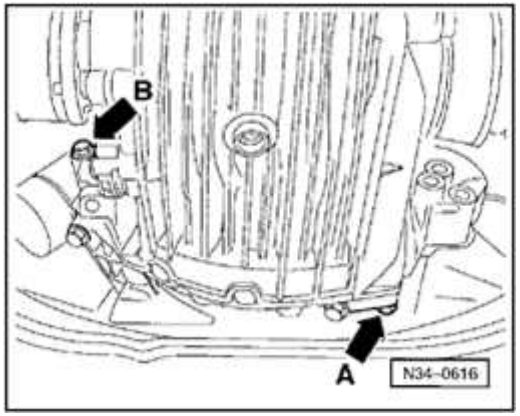
6-cylinder engine



- Remove left and right transmission supports complete with bonded rubber mounts from transmission and subframe -1- and -2-.

34-29

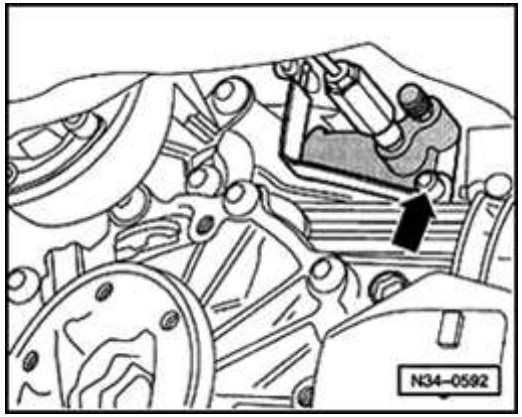
All models



- Remove remaining engine/transmission mounting bolts (arrows -A- and -B-).
- Press transmission off dowel sleeves and lower carefully using VAG1383A transmission jack just far enough for access to slave cylinder.

CAUTION!

When lowering the transmission, make sure the hydraulic line/hose to clutch slave cylinder is not damaged.



- Remove clutch slave cylinder (arrow) and secure with wire, do not disconnect line.

CAUTION!

After removing the clutch slave cylinder, do not operate the clutch pedal.

Make sure there is sufficient clearance of the flange shafts when lowering the transmission.

- Lower transmission completely.

Note:

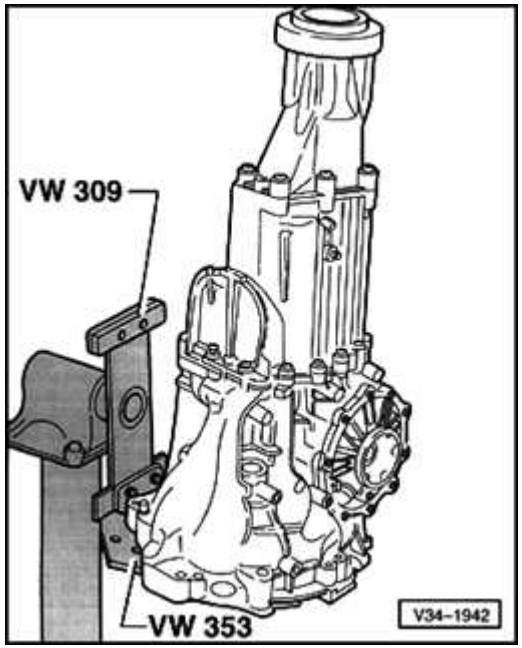
Make sure drive axles have sufficient clearance when lowering transmission.

34-30

Securing transmission to assembly stand

Special tools and equipment

- VW309 holding plate
- VW353 transmission support



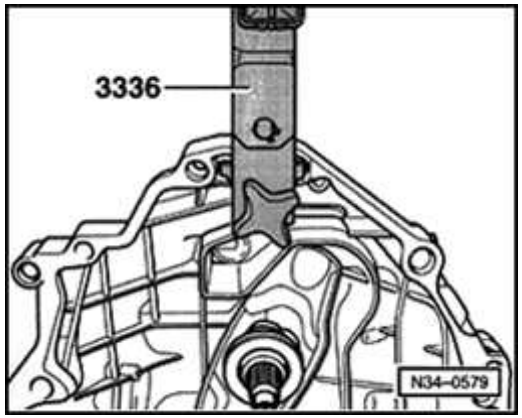
- Secure transmission to assembly stand using VW353 transmission support and VW309 holding plate when working on transmission.

Transporting the transmission

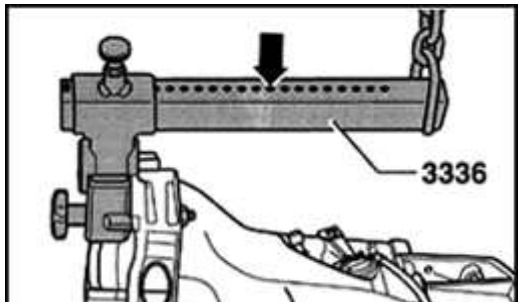
Special tools and equipment

- 3282 transmission support
- 3336 transmission support jig

The transmission support jig can be used when transporting the transmission and for setting up 3282 transmission support.



- Bolt 3336 transmission support jig to transmission housing.



- Adjust support jig on sliding piece using locking pin.

  Number of holes visible (arrow): 17

- Lift transmission using workshop crane and 3336 transmission support jig.

Installing

Install in reverse order of removal, note the following:

- Clean input shaft splines and (in case of used clutch plates) hub splines. Remove corrosion and apply only very thin coating of lubricant G 000 100 on splines. Do not grease guide sleeve.

- Check clutch release bearing for wear, replace if necessary.

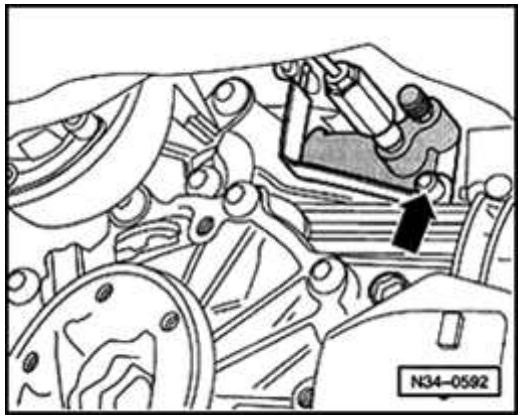
- Coat contact surface of clutch slave cylinder pivot rod with thin layer of copper grease, e.g. 381 351 TE.

- Threaded holes for mounting clutch slave cylinder to transmission and shift lever to shift rod must be cleaned of locking compound residue using thread tap before installation .

- Make sure dowel sleeves for aligning engine/transmission are installed in cylinder block, install if necessary.

- Always replace self locking nuts.

34-33



- Lift up transmission until clutch slave cylinder with mounting bracket for line/hose can be installed (arrow).
- Install intermediate plate (if applicable) between transmission and engine onto appropriate engine dowel sleeves.
- Make sure intermediate plate is correctly positioned on engine.
- Install lower engine/transmission and starter mounting bolts, and install starter ⇒ *Repair Manual, Electrical Equipment, Repair Group 27*
- Before installing, use tap to clean threads in flange shaft for driveshaft on transmission to remove traces of locking compound.
- Replace gaskets on drive axles and on front of driveshaft ⇒ Page 39-69 .
- Install driveshaft ⇒ Page 39-71 .
- Check adjustment of shift rod and pivot rod, re-adjust if necessary ⇒ Page 34-12 .

- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Check transmission oil level ⇒ Page 34-38 .

- After connecting battery, enter anti-theft code for radio

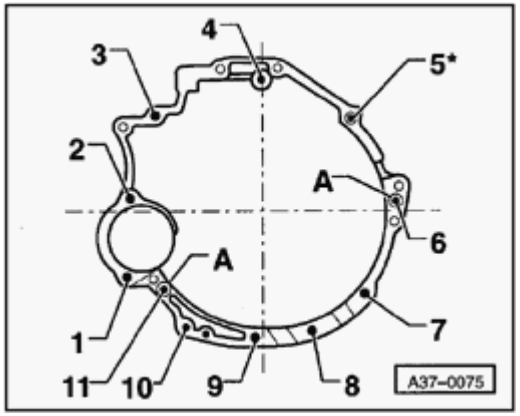
  ⇒ *Repair Manual, Electrical Equipment, Repair Group 91*

- Run power windows fully up by pressing switches.

- Operate all power window switches again and hold for at least one second in "close" position to activate automatic one-touch function.

- Set clock to correct time.

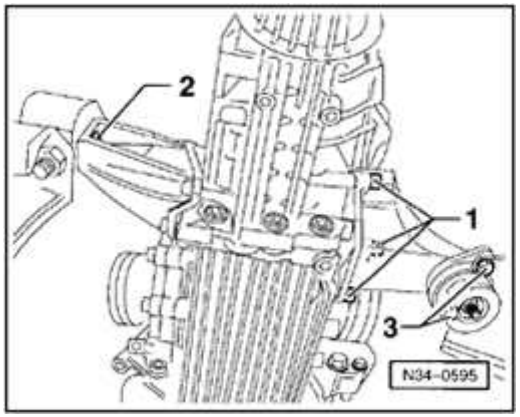
Tightening torques



➢ Transmission to engine (4-cylinder)

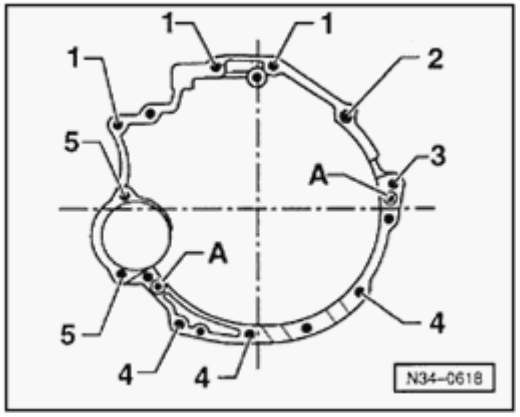
Item No.	Bolt	Tightening torque
1, 3, 4	M12 x 67	65 Nm (48 ft lb)
2, 6	M12 x 90	65 Nm (48 ft lb)
5, 11	M12 x 110	65 Nm (48 ft lb)
7 - 10	M10 x 45	45 Nm (33 ft lb)

A: Dowel sleeves



➢ Transmission/engine assembly mount (4-cylinder)

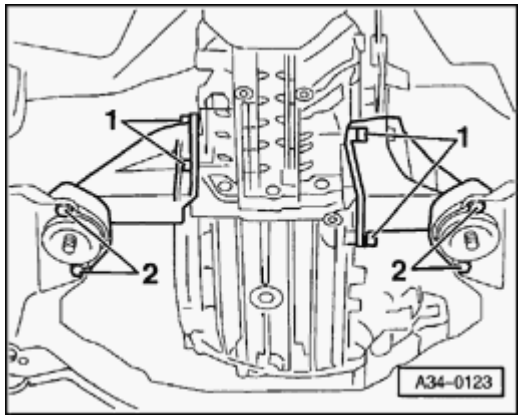
Item No.	Bolt	Qty.	Tightening torque
1	M10 x 30	3	40 Nm (30 ft lb)
2	M10 x 35	1	50 Nm (37 ft lb)
3	M8 x 20	2	23 Nm (17 ft lb)



Transmission to engine (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M12 x 67	3	65 Nm (48 ft lb)
2	M12 x 90	1	65 Nm (48 ft lb)
3	M12 x 80	1	65 Nm (48 ft lb)
4	M10 x 45	3	45 Nm (33 ft lb)
5	M10 x 135	1	45 Nm (33 ft lb)
51)	M12 x 130	1	65 Nm (48 ft lb)
1) Upper starter bolt			

A: Dowel sleeves



Transmission/engine assembly mount (6-cylinder)

Item No.	Bolt	Qty.	Tightening torque
1	M10 x 35	3	40 Nm (30 ft lb)
2	M8 x 20	2	23 Nm (17 ft lb)

Component	Nm	ft lb
Drive axle to flange shaft M8	40	30
Drive axle to flange shaft M10	80	59
Engine speed sensor -G28-	10	7
Clutch slave cylinder to transmission	20	15
Heat shields over drive axles on transmission	23	17
Shift rod to transmission	23	17
Pivot rod to transmission	40	30
Driveshaft to transmission	55	41
Heat shield for driveshaft to cover of Torsen differential	25	18
Three Way Catalytic Converter (TWC) to mounts	25	18
Front exhaust pipe to turbocharger or exhaust manifold	25	18
Clamp for exhaust pipe	40	30
Bracket for noise insulation panel to body	25	18

34-36

Transmission oil level, checking

Special tools and equipment

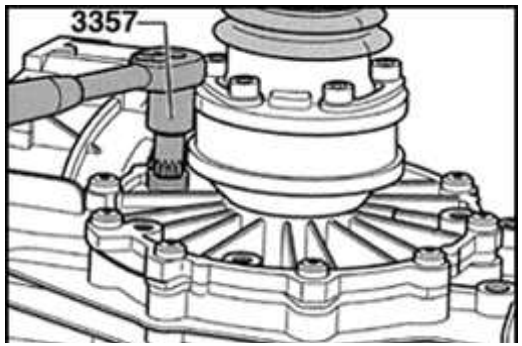
- 17 mm wrench insert hex socket

or

- 3357 triple square socket driver

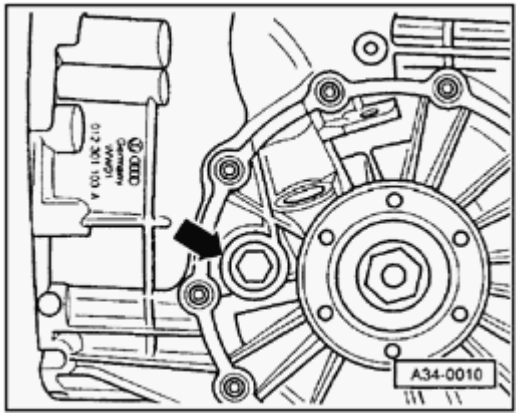
Notes:

- *Vehicle must be level when checking transmission oil level. This can be achieved using a pit or 4-post lift.*
- *The oil filler plug is on left side of the transmission underneath the engine speed (RPM) sensor, and may be concealed by a heat shield over the drive axle.*



- *Depending on the version installed, use either 3357 triple square socket driver or a 17 mm hex socket to loosen the oil drain plug.*

34-37



- To check oil level, remove oil filler plug (arrow).
- Check oil level with hand-made tool, e.g. bent wire.

  Specification: oil 7 mm (0.276 in.) below bottom of filler hole.

Note:

Service departments may fill oil up to bottom of oil filler hole.

- Top off transmission oil if necessary.

  Specification ⇒ Page 00-3 .
- Install oil filler plug.

  Tightening torque: 25 Nm (18 ft lb).

34-38

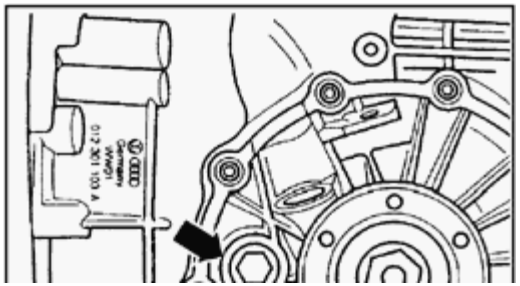
Transmission oil level, checking

Special tools and equipment

- 17 mm wrench insert hex socket or
- 3357 triple square socket driver

Notes:

- *The oil filler plug is on the left of the transmission below the speedometer vehicle speed sensor and may be concealed by the heat shield for the drive axle.*
- *Depending on the version installed, use either 3357 triple square socket driver or a 17 mm to loosen the oil filler plug.*
- *Use 3357 triple square socket driver to loosen the oil drain plug.*



- To check oil level, remove oil filler plug (arrow).

  Specification: Oil level up to bottom of filler hole
- Top off transmission oil if necessary.

  Specification ⇒ Page 00-3

- Install oil filler plug.

  Tightening torque: 25 Nm (18 ft lb)

34-39

Cover with Torsen differential, removing and installing

- Transmission installed

Special tools and equipment

- 3337 ring spanner 7-piece set (only for vehicles with 6-cylinder engine)
- VAG1306 drip tray

Removing

4-cylinder engine

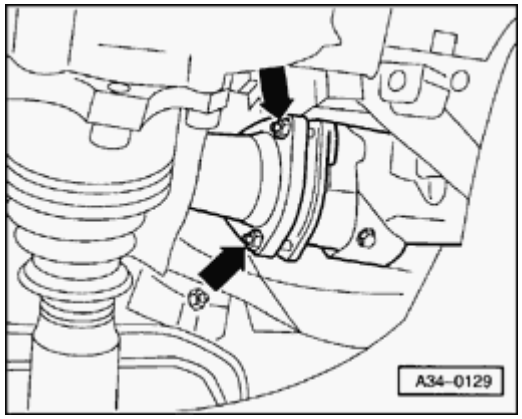
- Remove rear section of exhaust system (rearward of exhaust pipe clamp).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

6-cylinder engine

- Remove Heated Oxygen Sensor (HO2S) from right exhaust pipe using 3337 ring spanner 7-piece set, and move clear to side.
- Remove heat shield above right drive axle.

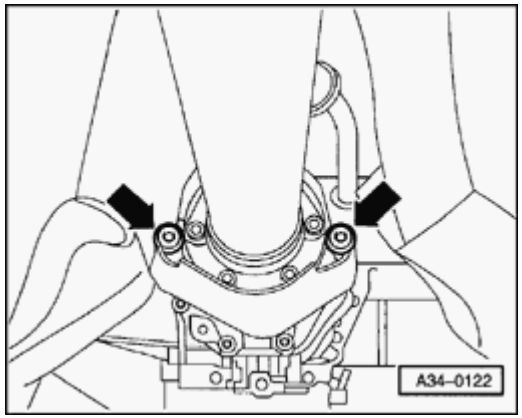
34-40



- Remove front exhaust pipe together with Three Way Catalytic Converter (TWC) (right side) from exhaust manifold (arrows) (3 nuts).

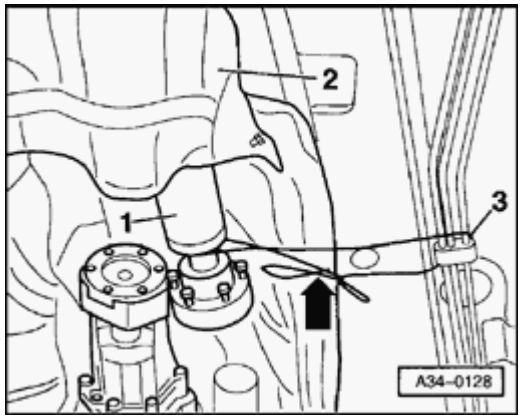
⇒ Repair Manual, Engine Mechanical, Repair Group 26

All models

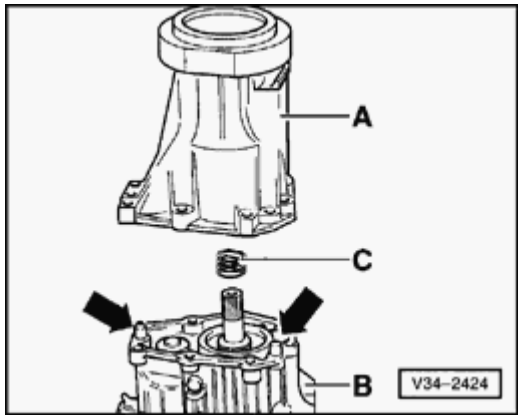


- Remove heat shield for driveshaft from Torsen differential cover (arrows).

34-41



- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrow).
- Place VAG1306 underneath and drain gear oil.



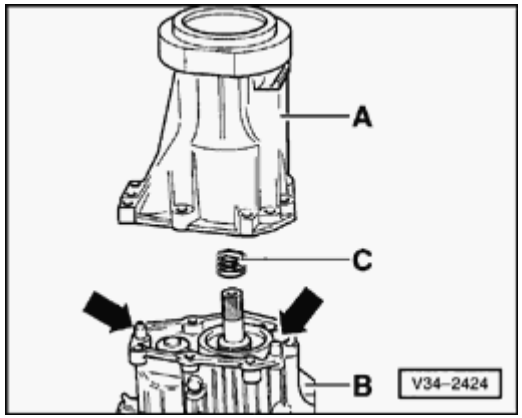
- Remove cover -A- together with Torsen differential from transmission cover -B-.

Note:

Illustration is shown with transmission removed.

- Remove compression spring -C- from drive pinion.

Torsen differential cover, servicing, removing and installing ⇒ Page 34-68



Installing

Install in reverse order of removal, note the following:

- Clean sealing surfaces and coat with AMV 188 000 02.

- Make sure dowel sleeves for Torsen differential cover -A- are installed in transmission cover -B- (arrows).
- Install compression spring -C- over drive pinion onto hollow shaft
- Install driveshaft ⇒ Page 39-71 .
- Check oil level in transmission and top up if necessary ⇒ Page 34-38 .
- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torque

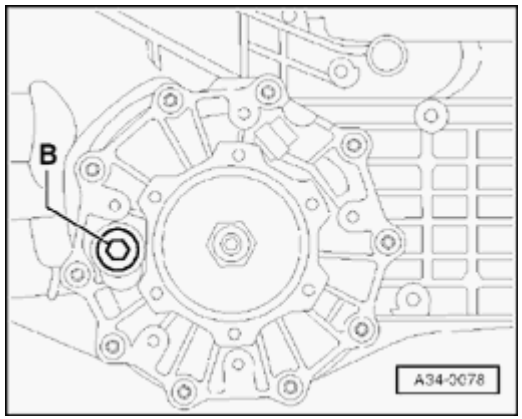
Component	Tightening torque
Cover with Torsen differential to transmission	25 Nm (18 ft lb)
Driveshaft to transmission	55 Nm (41 ft lb)
Heat shield for driveshaft to Torsen differential cover	25 Nm (18 ft lb)

34-39

Oil level in transmission, checking

Note:

- *When checking the oil level in the transmission, the vehicle should be standing on a perfectly horizontal surface. An inspection pit or a 4-post lifting platform is ideal.*
- *The prescribed oil level is to be adhered to exactly; the transmission reacts very sensitively to over-filling.*
- *If a transmission with transmission oil cooling (e.g. 2.7 ltr bi-turbo) has been removed, the vehicle must be driven a short distance on the road before checking the transmission oil level.*



- Remove oil filler plug -B- (in front of drive flange) to check transmission oil level.
- Check oil level with a suitable tool (such as a length of wire bent to shape).

Vehicles with V6 bi-turbo engine

- Specification: oil level 7 mm ± 1 mm below bottom lip of oil filler hole.

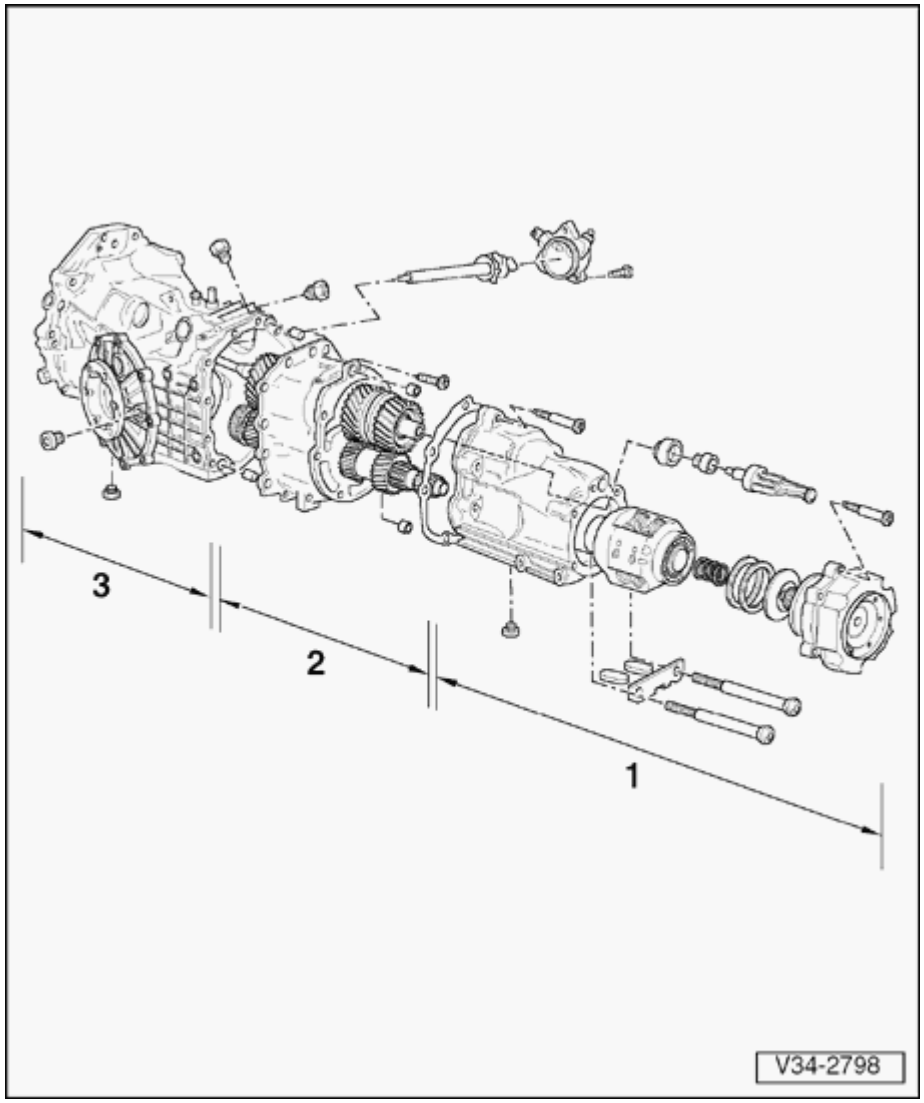
- Fill up with gear oil if necessary. Specification ⇒ Page 00-3 .

- Fit oil filler plug.

Tightening torque

Oil filler plug: 40 Nm

34-40



Transmission, disassembling and assembling

Assembly sequence ⇒ Page 34-54 .

1 - Bearing housing, Torsen differential and end cover

- Removing and installing ⇒ Page 34-41

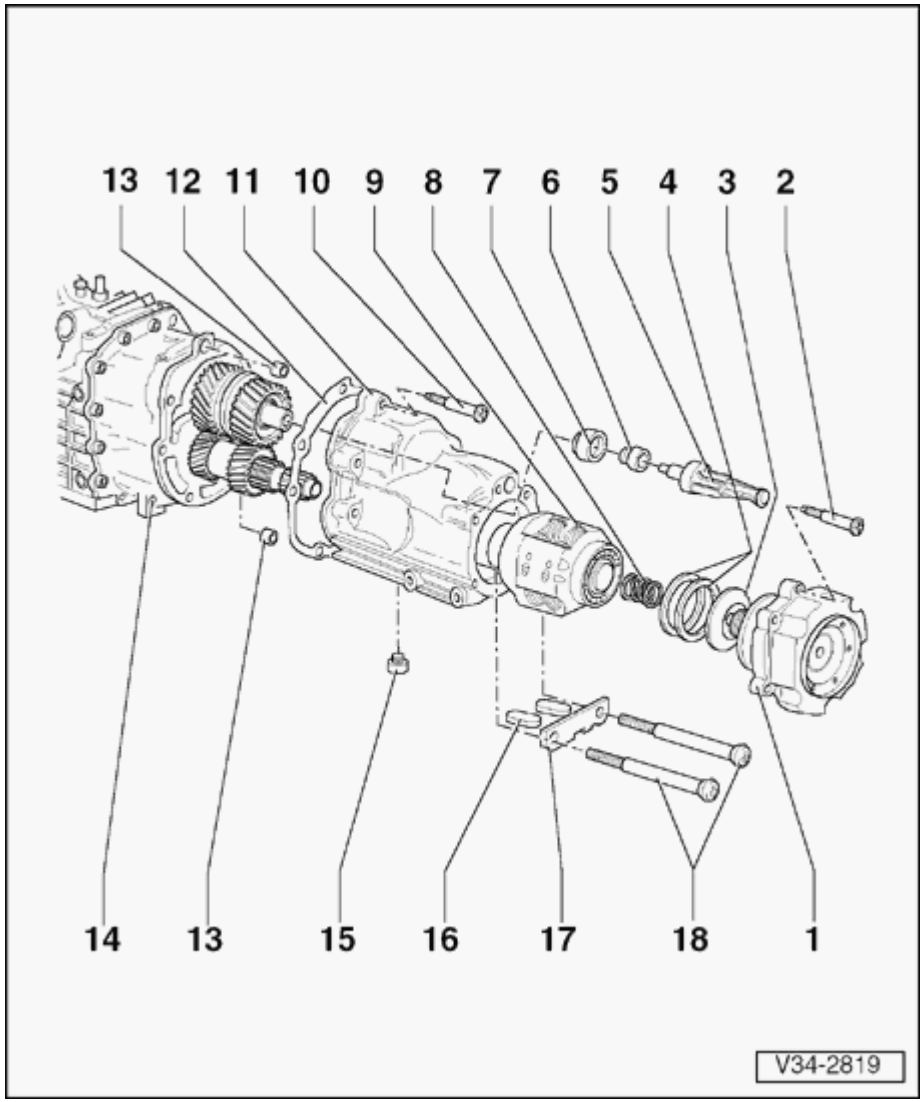
2 - Gear cluster and selector shaft

- Removing and installing ⇒ Page 34-44

3 - Differential

- Removing and installing ⇒ Page 39-15

34-41



Bearing housing, Torsen differential and end cover, removing and installing

1 - Bearing housing

- Disassembling and assembling ⇒ Page 34-89

2 - Bolt, 25 Nm

- Qty. 6

3 - Dished spring

- Installation position: larger diameter (concave side) faces shims

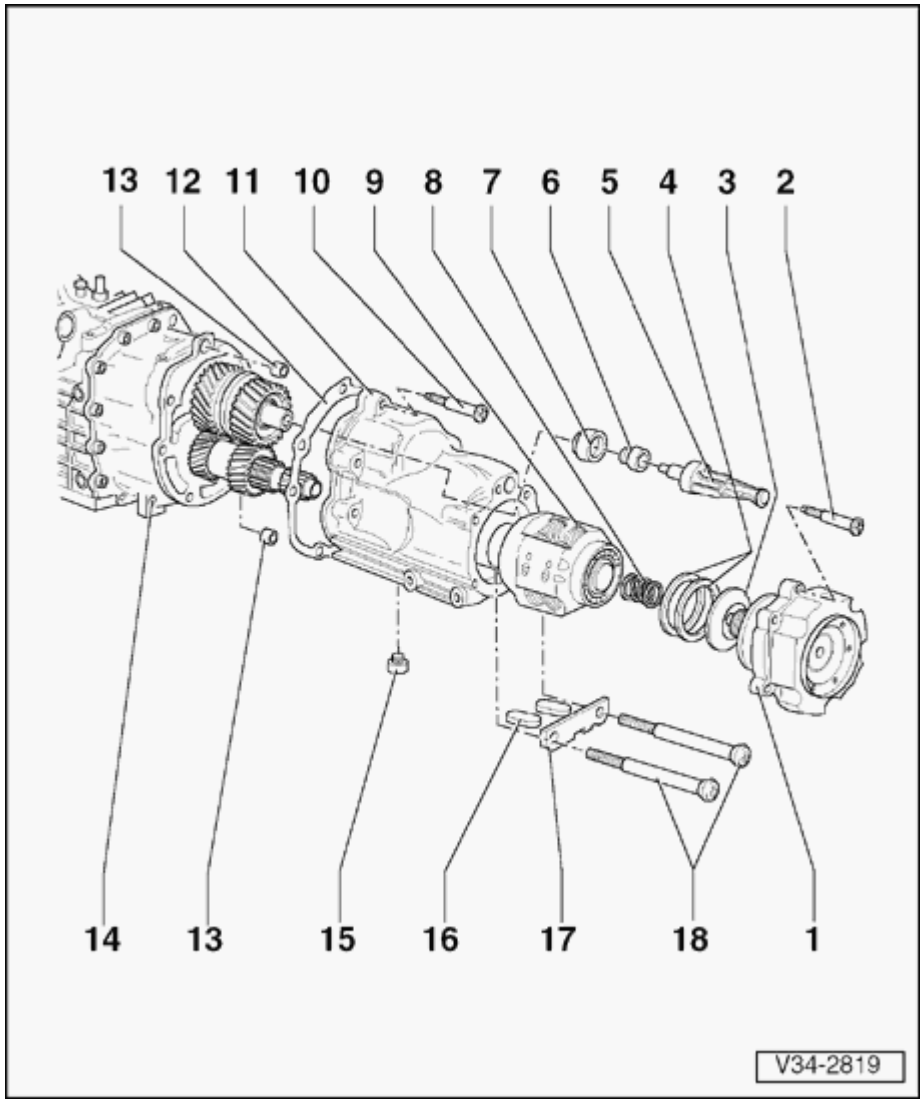
4 - Shim

- Qty. 2 or 3
- Re-determining shims ⇒ Page 34-85

5 - Oil collector

- Disassembling and assembling ⇒ Page 34-83
- Removing ⇒ Page 34-58
- Installing ⇒ Page 34-84

34-42



6 - Multi-point socket head bolt, 150 Nm

- Removing ⇒ Page 34-60
- Installing ⇒ Page 34-83

7 - 2nd inner race for tapered roller bearing for input shaft

- Removing ⇒ Page 34-61
- Installing ⇒ Page 34-82

8 - Spring

9 - Torsen differential

- Can be serviced only by manufacturer
- Servicing bearings for Torsen differential ⇒ Page 34-97

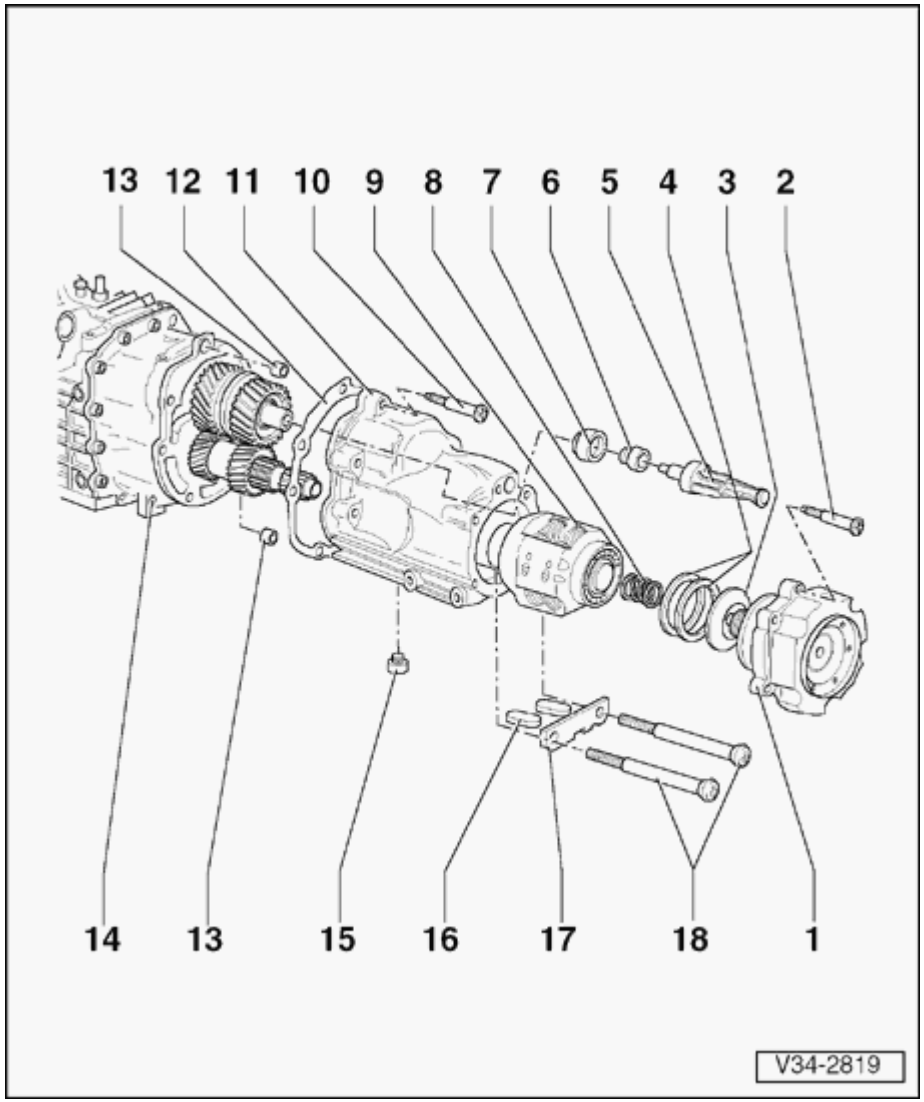
10 - Bolt, 25 Nm

- Qty. 5

11 - End cover

- Servicing ⇒ Page 34-97

34-43



12 - Gasket

- Replace

13 - Dowel sleeve

- Qty. 2

14 - Gear cluster

- Removing and installing ⇒ Page 34-18

15 - Oil drain plug - 40 Nm

16 - Magnet

- Qty. 2
- Clean

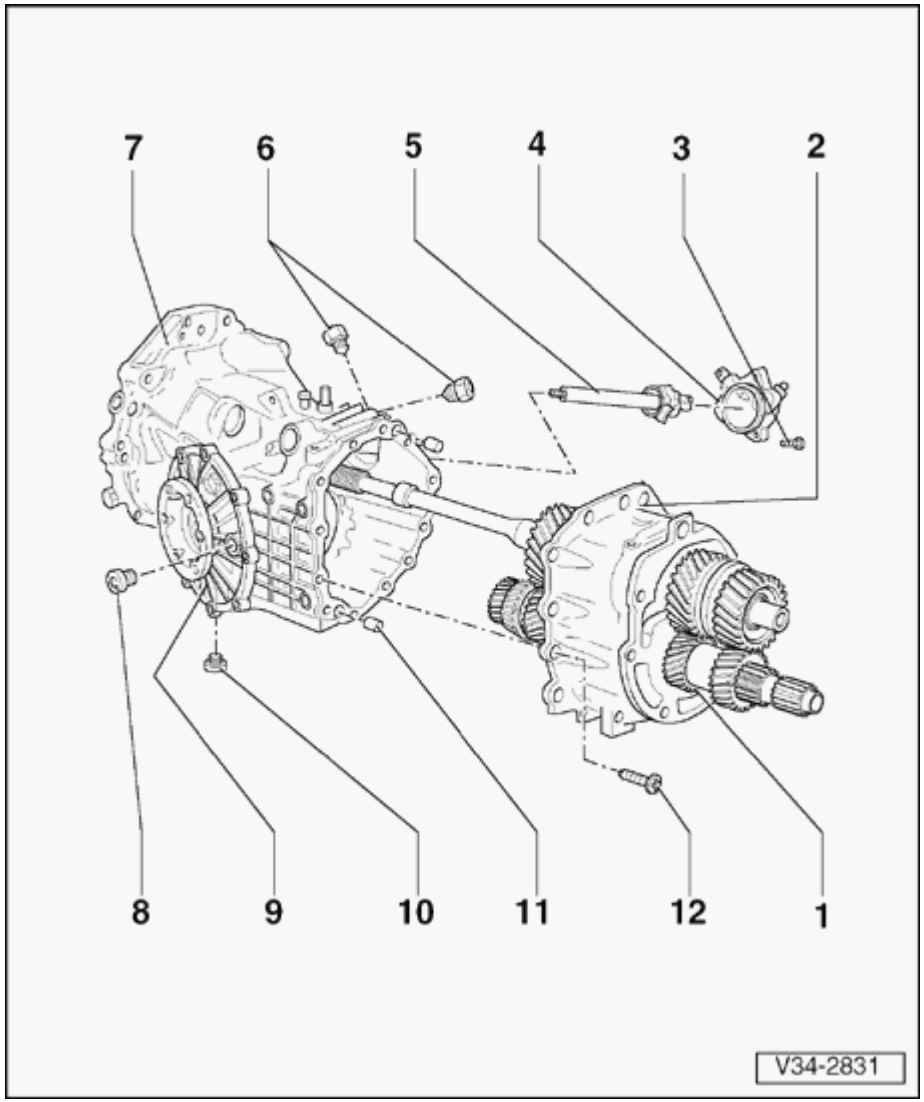
17 - Support plate

- Installation position: lugs face magnets

18 - Bolt, 25 Nm

- Qty. 2

34-44



Gear cluster and selector shaft, removing and installing

1 - 5th and 6th gear

- Gear cluster remains flanged to transmission housing
- Removing and installing ⇒ Page 34-47

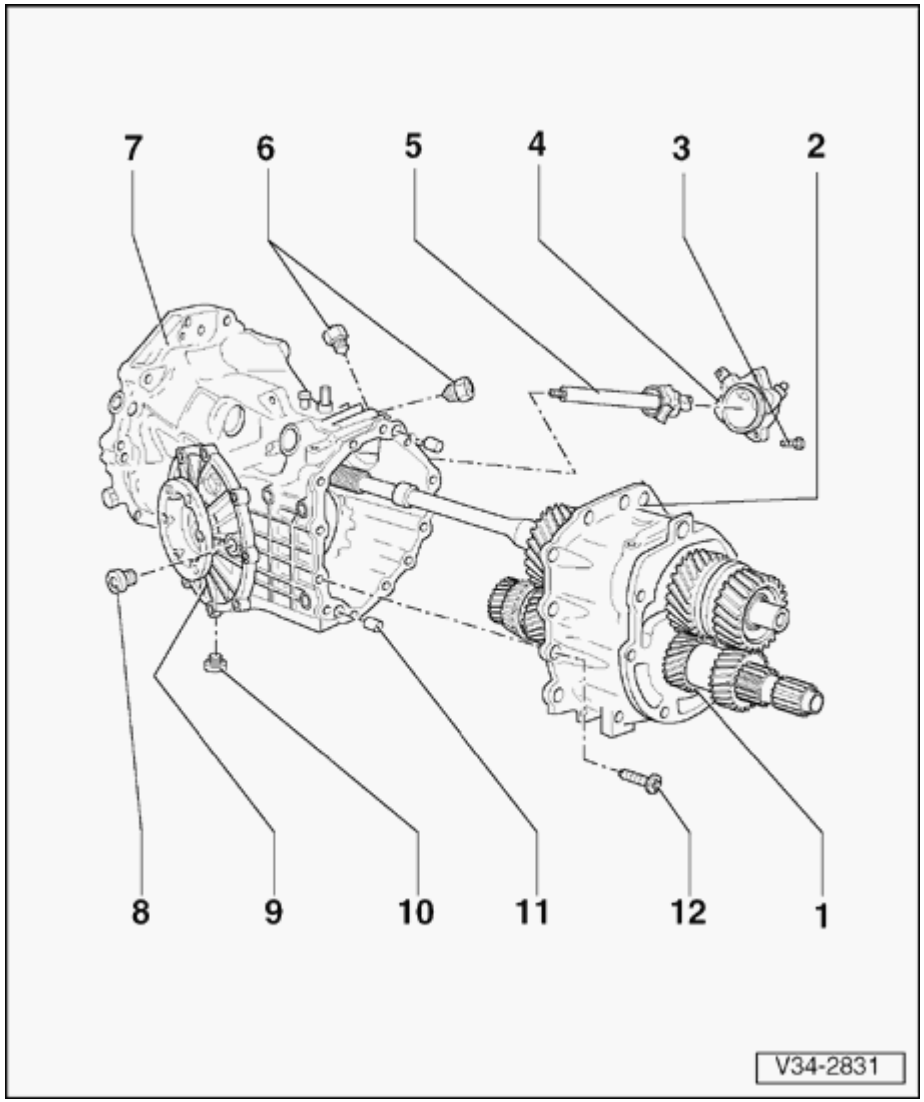
2 - Bearing plate complete

- Removing and installing input shaft, drive pinion, hollow shaft and internal selector mechanism ⇒ Page 34-51

3 - Bolt - 25 Nm

- Qty. 3
- Apply sealing paste AMV 188 000 02 when installing

34-45



4 - Cover for selector shaft

- Removing ⇒ Page 34-59
- Installing ⇒ Page 34-85

5 - Selector shaft complete

- Removing ⇒ Page 34-59
- Installing ⇒ Page 34-85
- Disassembling and assembling ⇒ Page 34-144

6 - Locking bolt

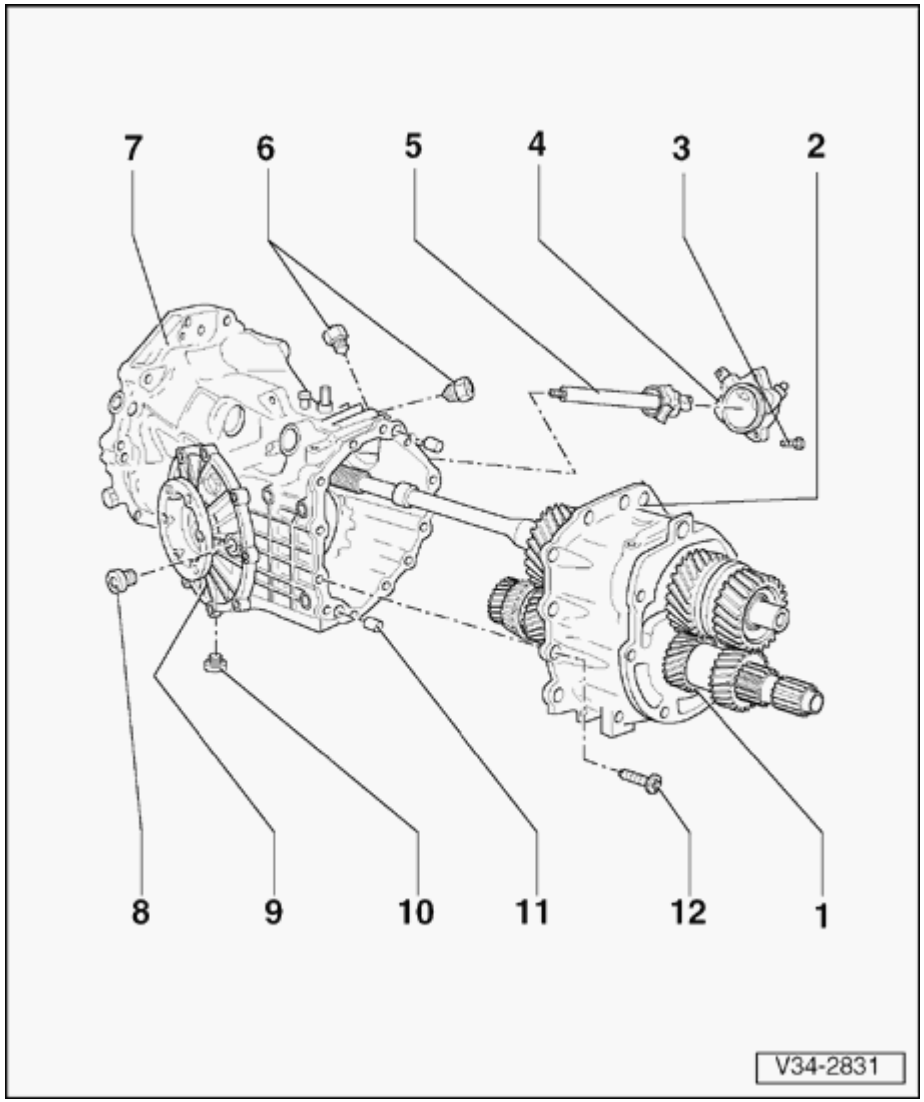
- For aluminium bolt: 50 Nm
- For steel bolt: 70 Nm
- Mark installation positions of aluminium bolts and steel bolts; do not interchange

7 - Transmission housing

- Servicing ⇒ Page 34-127

8 - Oil filler plug, 40 Nm

34-46



9 - Differential

- Removing and installing ⇒ Page 39-15

10 - Oil drain plug, 40 Nm

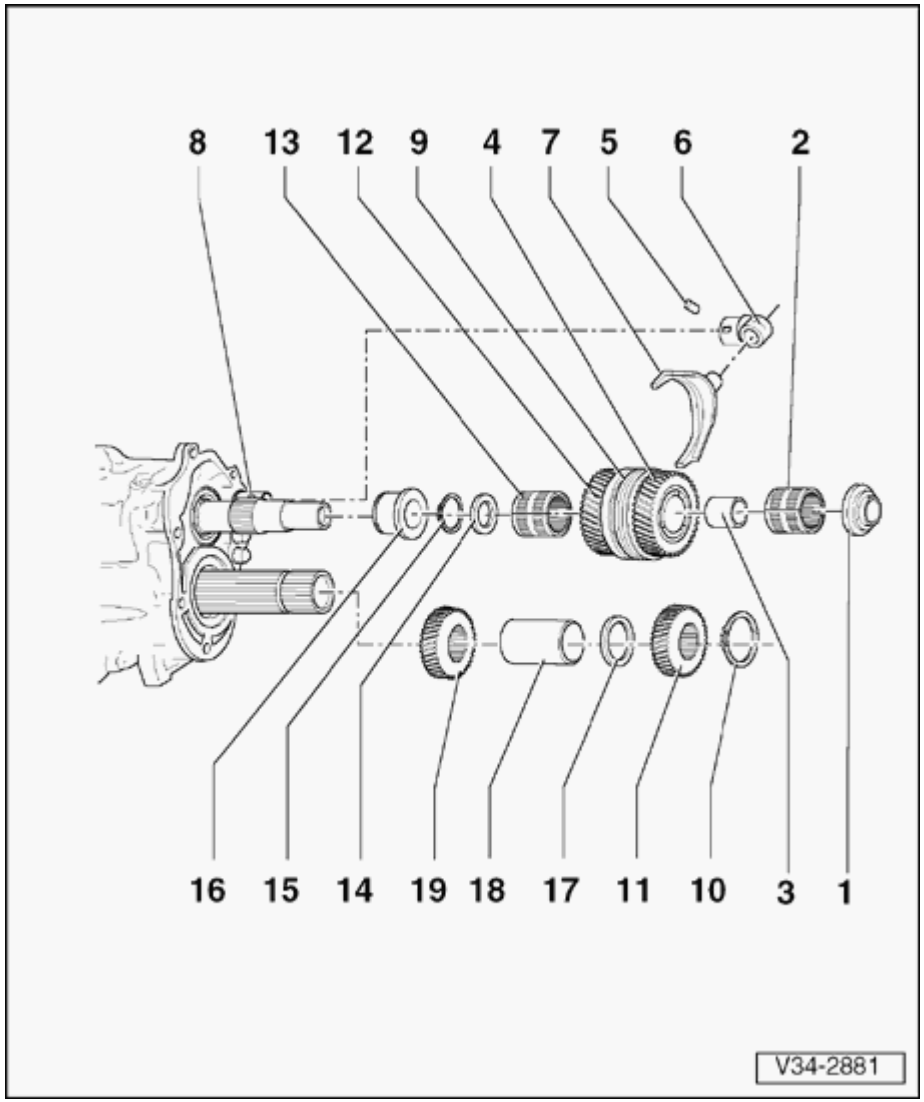
11 - Dowel sleeves

- Qty. 2

12 - Bolt, 25 Nm

- Qty. 12

34-47



5th and 6th gear, removing and installing

1 - 1st inner race for tapered roller bearing for input shaft

- Pulling off ⇒ Page 34-61
- Installing ⇒ Page 34-81

2 - Needle bearing for 5th gear

3 - Inner race for 5th speed sliding gear

- Pulling off ⇒ Page 34-64
- Driving on ⇒ Page 34-81

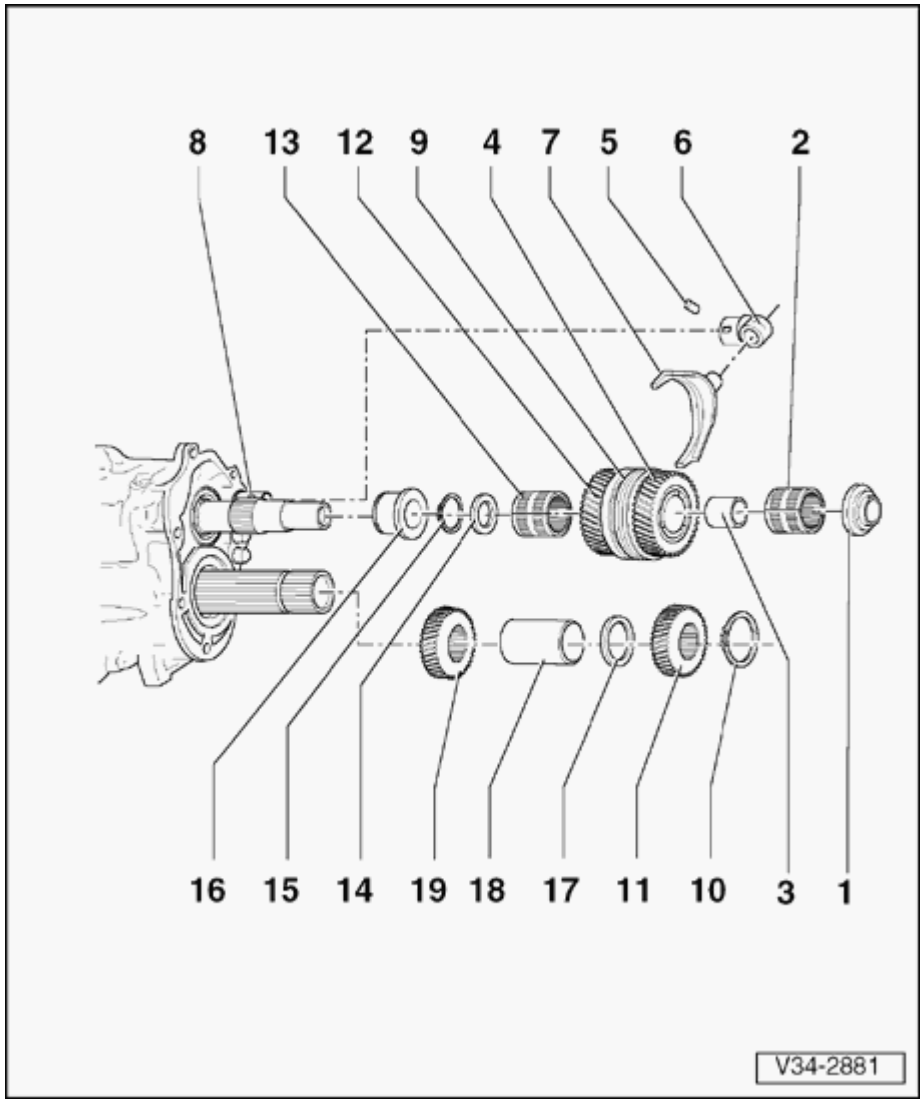
4 - 5th speed sliding gear

- Pulling off ⇒ Page 34-61
- Installing ⇒ Page 34-81

5 - Roll pin

- Pressing out ⇒ Page 34-62
- Pressing in ⇒ Page 34-77

34-48



6 - Follower

- Only replace complete with selector rod for 5th and 6th gear - 8 -
- Pulling off ⇒ Page 34-63
- Fitting ⇒ Page 34-77

7 - Selector fork for 5th and 6th gear

- Can be replaced individually

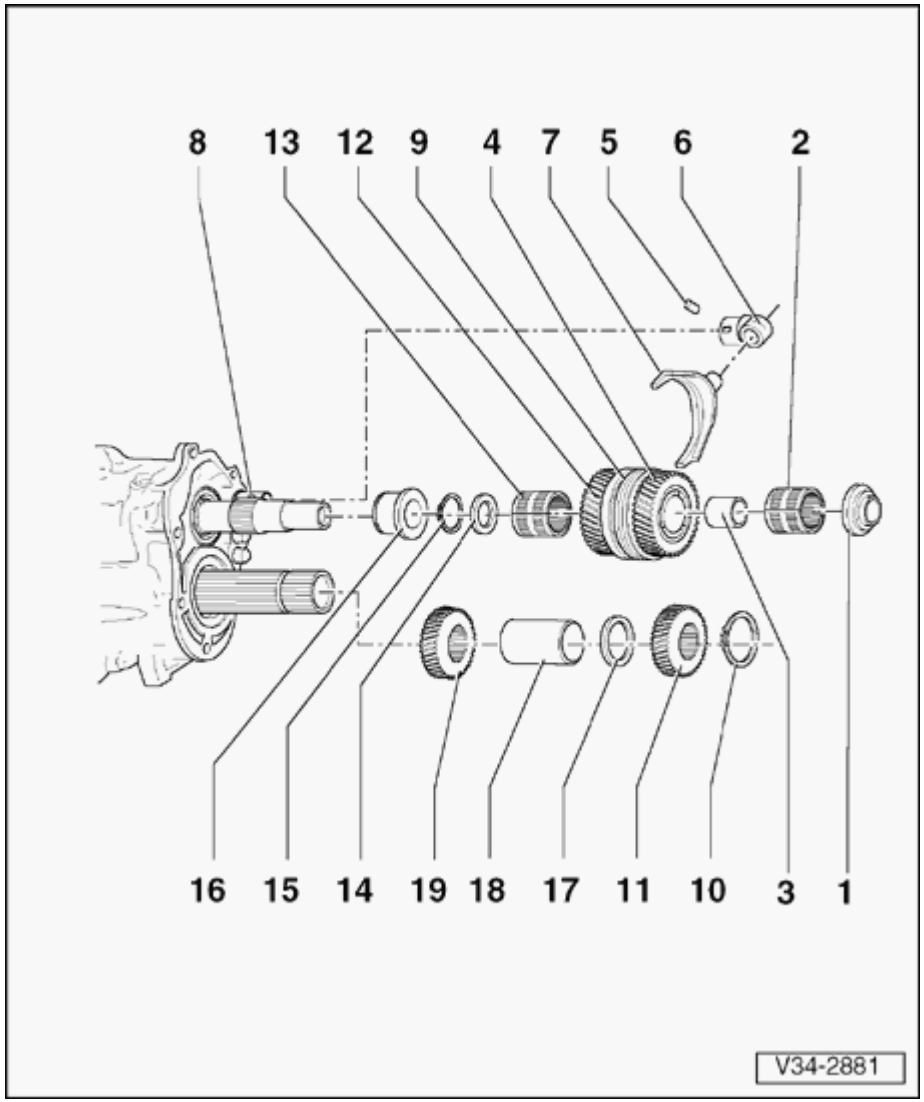
8 - Selector rod for 5th and 6th gear

- Only replace complete with follower - 6 -
- Removing ⇒ Page 34-62
- Installing ⇒ Page 34-72

9 - Locking collar, synchro-ring, synchro-hub for 5th and 6th gear

- Removing ⇒ Page 34-63
- Installing ⇒ Page 34-76

34-49



10 - Circlip

- Re-determining ⇒ Page 34-80

11 - 5th speed gear

- Pulling off ⇒ Page 34-62
- Pressing on ⇒ Page 34-79

12 - 6th speed sliding gear

- Pull off together with synchro-hub and inner race for 5th gear ⇒ Page 34-64

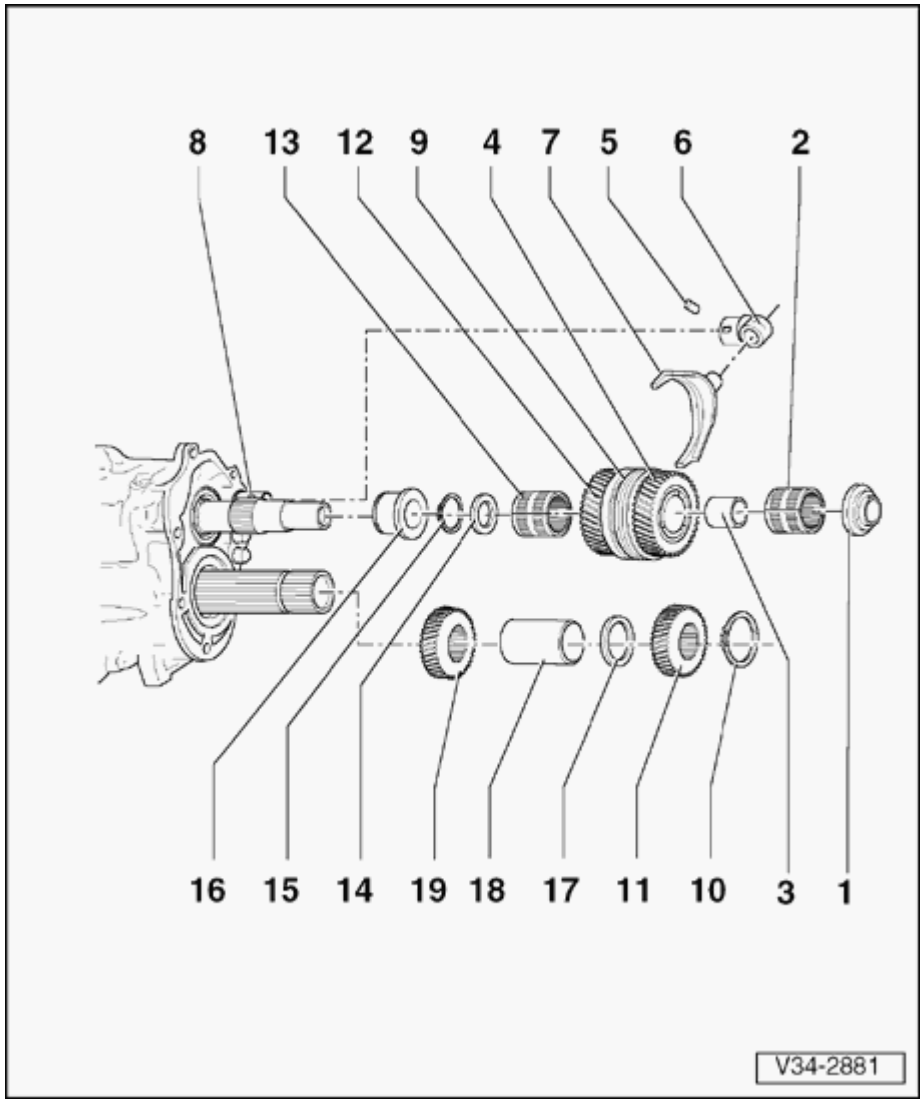
13 - Needle bearing for 6th gear

14 - Thrust washer for needle bearing for 6th gear

- Installation position: grooves face circlip, smooth face contact surface towards needle bearing

15 - Circlip

34-50



16 - Inner race for cylinder roller bearing

- Take off by hand ⇒ Page 34-65

17 - Shim

- Re-determine thickness ⇒ Page 34-78

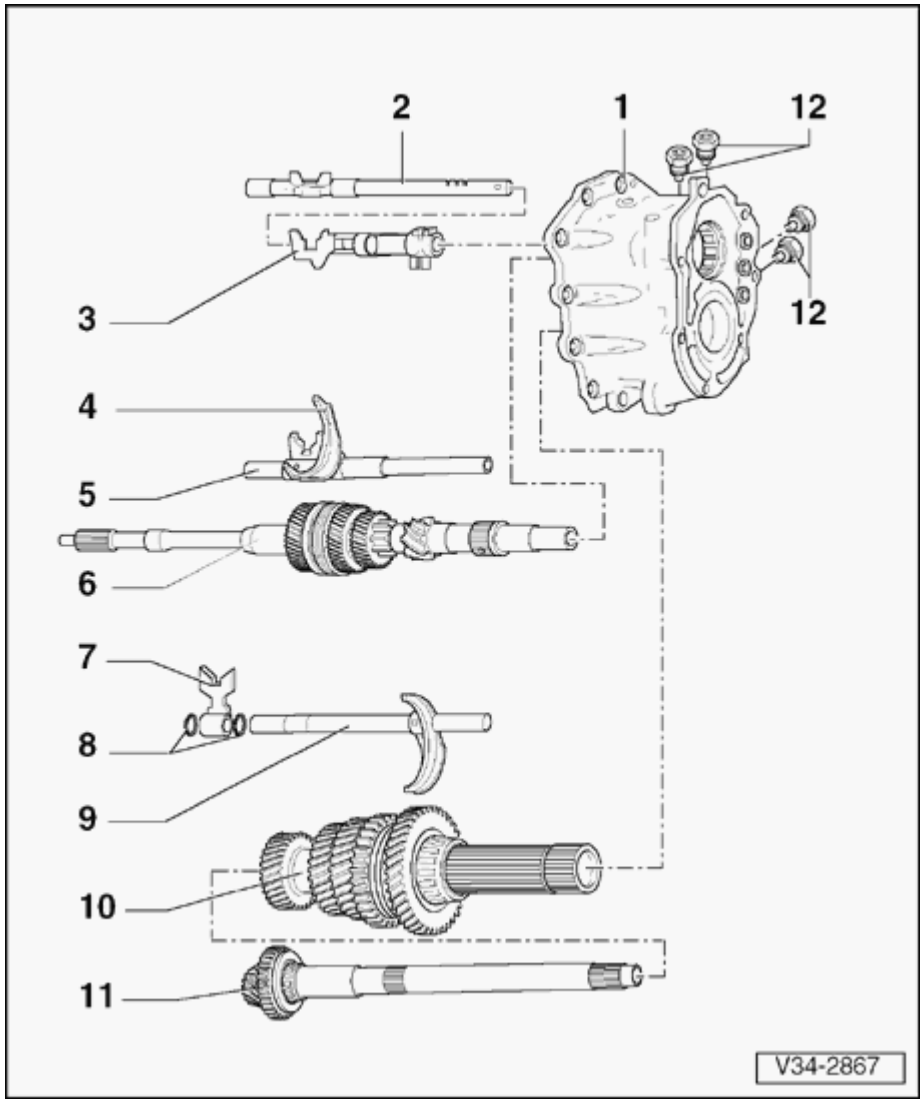
18 - Spacer sleeve

- Length 39.6 mm

19 - 6th speed gear

- To press off, remove bearing plate ⇒ Page 34-65
- Pressing off ⇒ Page 34-68
- Pressing on ⇒ Page 34-69

34-51



Input shaft, drive pinion, hollow shaft and internal selector mechanism from bearing plate, removing and installing

1 - Bearing plate

- Servicing ⇒ Page 34-112

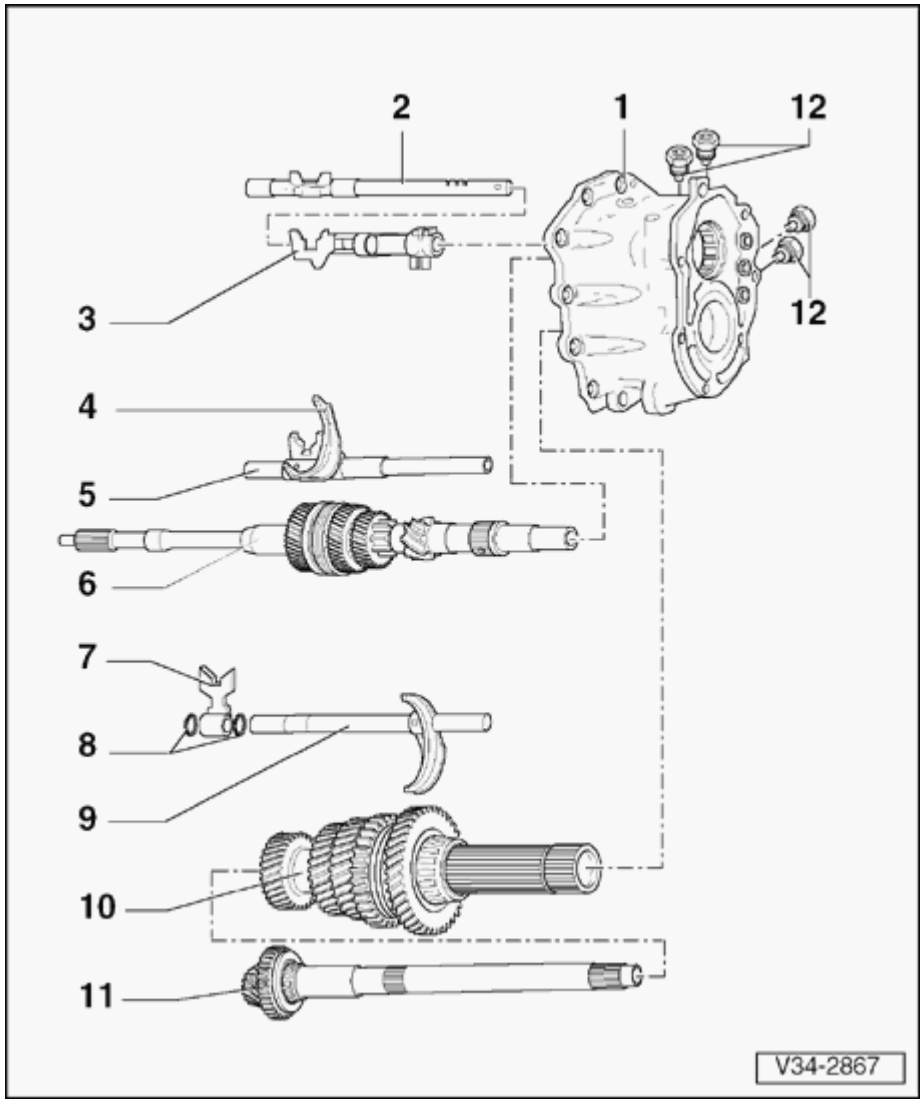
2 - Selector rod for 5th and 6th gear

- Only replace complete with follower for 5th and 6th gear ⇒ Page 34-48

3 - Follower for reverse gear

- Pulling out ball sleeve ⇒ *Fig. 3* , Page ⇒ Page 34-118
- Driving in ball sleeve ⇒ *Fig. 4* , Page ⇒ Page 34-119

34-52



4 - Selector fork for 3rd and 4th gear

- Can be replaced individually
- Installation position: rib towards follower

5 - Selector rod for 3rd and 4th gear

- Only replace complete with follower for 3rd and 4th gear

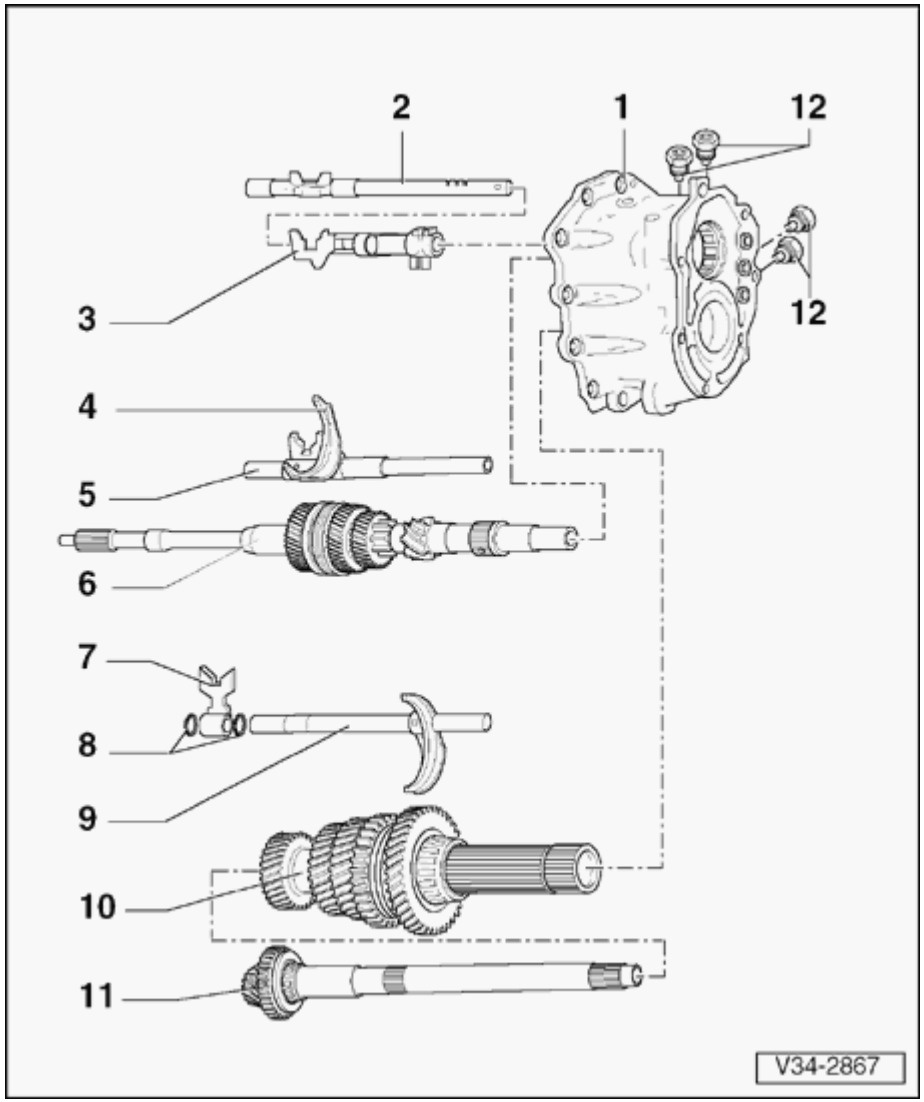
6 - Input shaft

- Disassembling and assembling ⇒ Page 35-1

7 - Follower for 1st and 2nd gear

- Can be replaced individually

34-53



8 - Circlip

- Qty. 2

9 - Selector rod for 1st and 2nd gear

- Only replace together with selector fork for 1st and 2nd gear (secured together by means of a pin)

10 - Hollow shaft

- Disassembling and assembling ⇒ Page 35-13

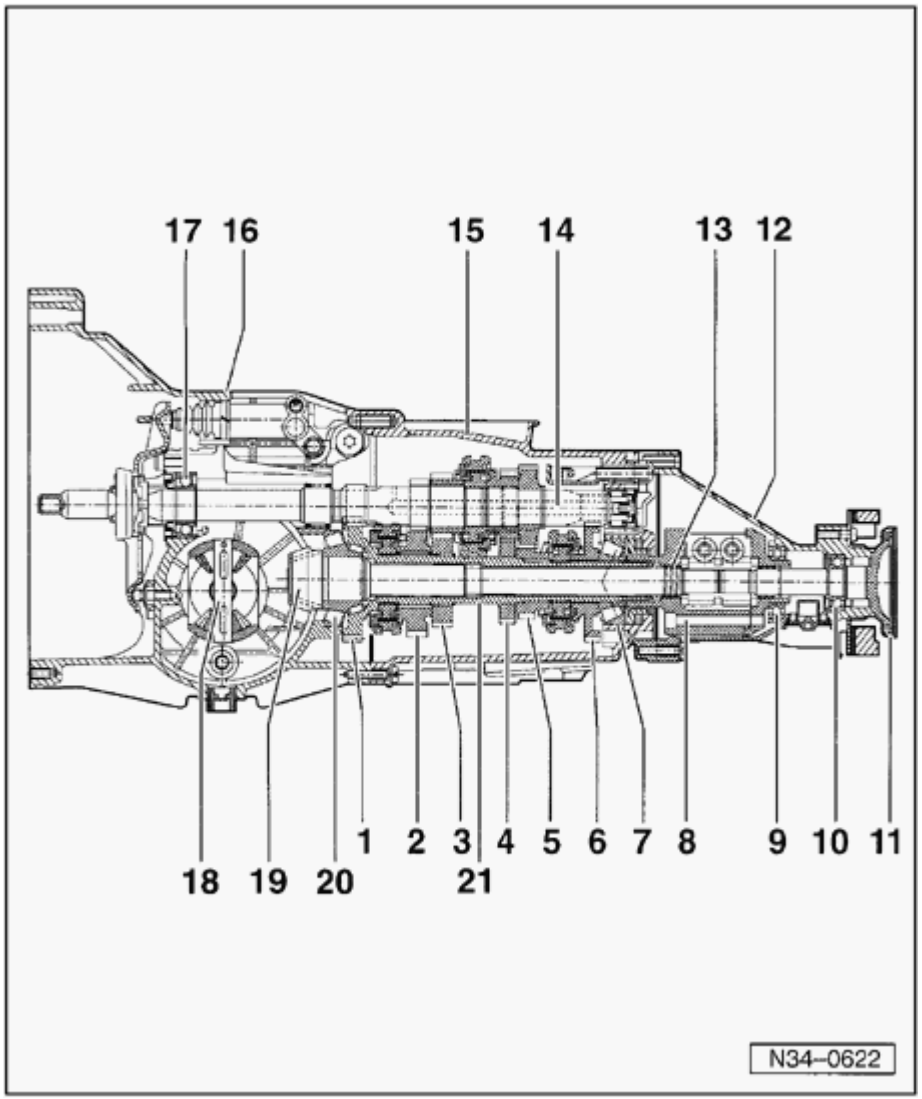
11 - Drive pinion

- Disassembling and assembling ⇒ Page 35-13

12 - Locking bolts

- Qty. 4
- For aluminium bolt: 50 Nm
- For steel bolt: 70 Nm
- Mark installation positions of aluminium bolts and steel bolts; do not interchange

34-43



Transmission, disassembling and assembling

Disassembly sequence ⇒ Page 34-55 .

Transmission overview

1 - 1st gear

2 - 2nd gear

3 - 3rd gear

4 - 4th gear

5 - 5th gear

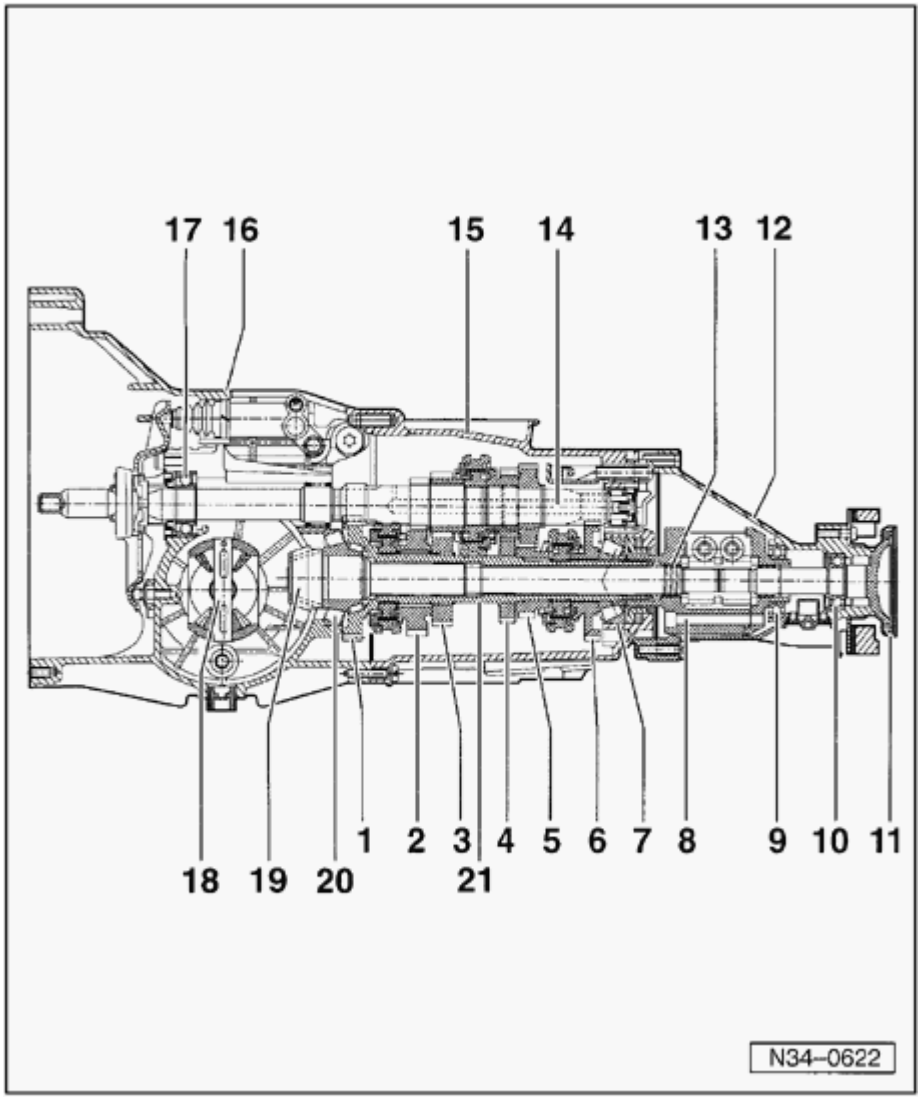
6 - Reverse gear

- Removing and installing reverse idler gear ⇒ Page 35-44

7 - Tapered roller bearing

- Adjusting ⇒ Page 39-39

34-44



8 - Torsen differential

- Can only be serviced by manufacturer
- Removing and installing together with cover ⇒ Page 34-39

9 - Bearing

10 - Bearing

11 - Flange shaft

12 - Torsen differential cover

13 - Compression spring

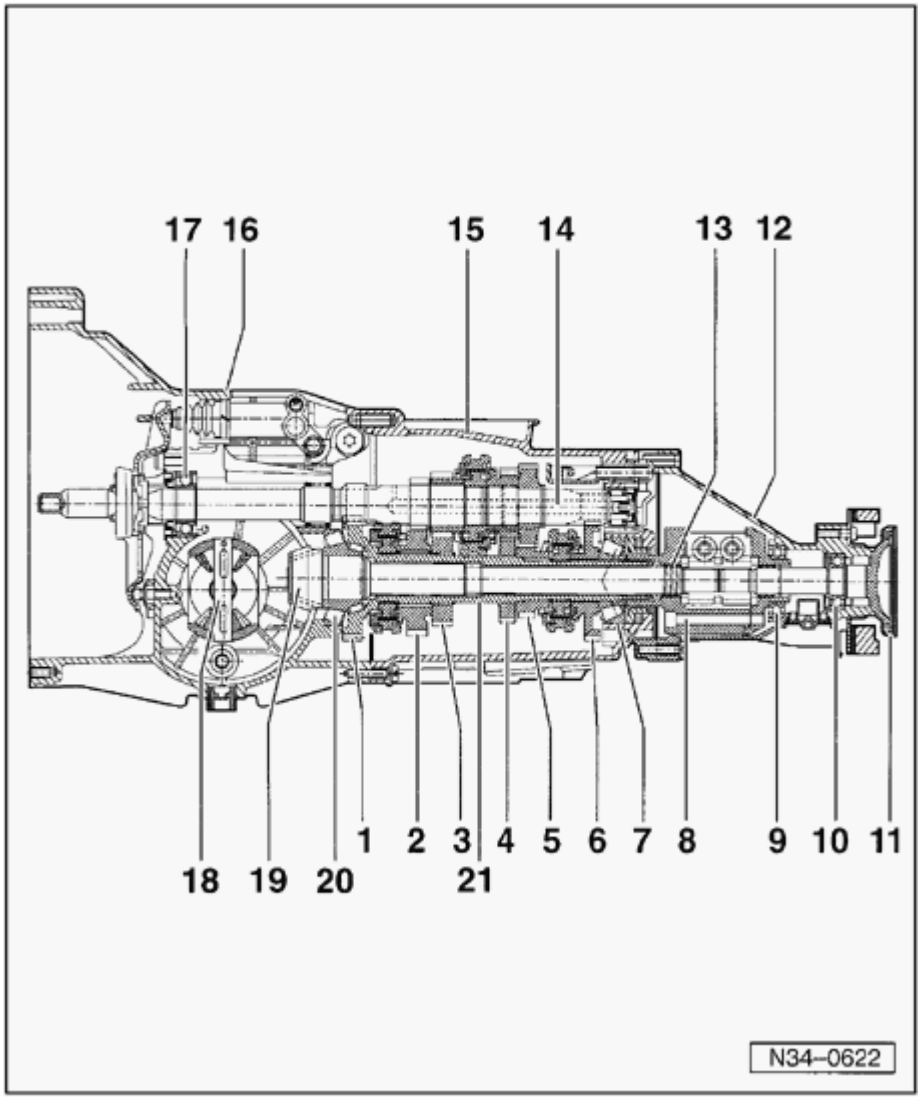
- Between Torsen differential and hollow shaft

14 - Input shaft

- Disassembling and assembling ⇒ Page 35-1

15 - Transmission cover

34-45



16 - Transmission housing

17 - Ball bearing

- Adjusting thickness ⇒ Input shaft, adjusting ⇒ Page 35-17

18 - Differential

- Removing and installing ⇒ Page 39-16
- Disassembling and assembling ⇒ Page 39-21

19 - Drive pinion

- Disassembling and assembling drive pinion and hollow shaft ⇒ Page 35-21

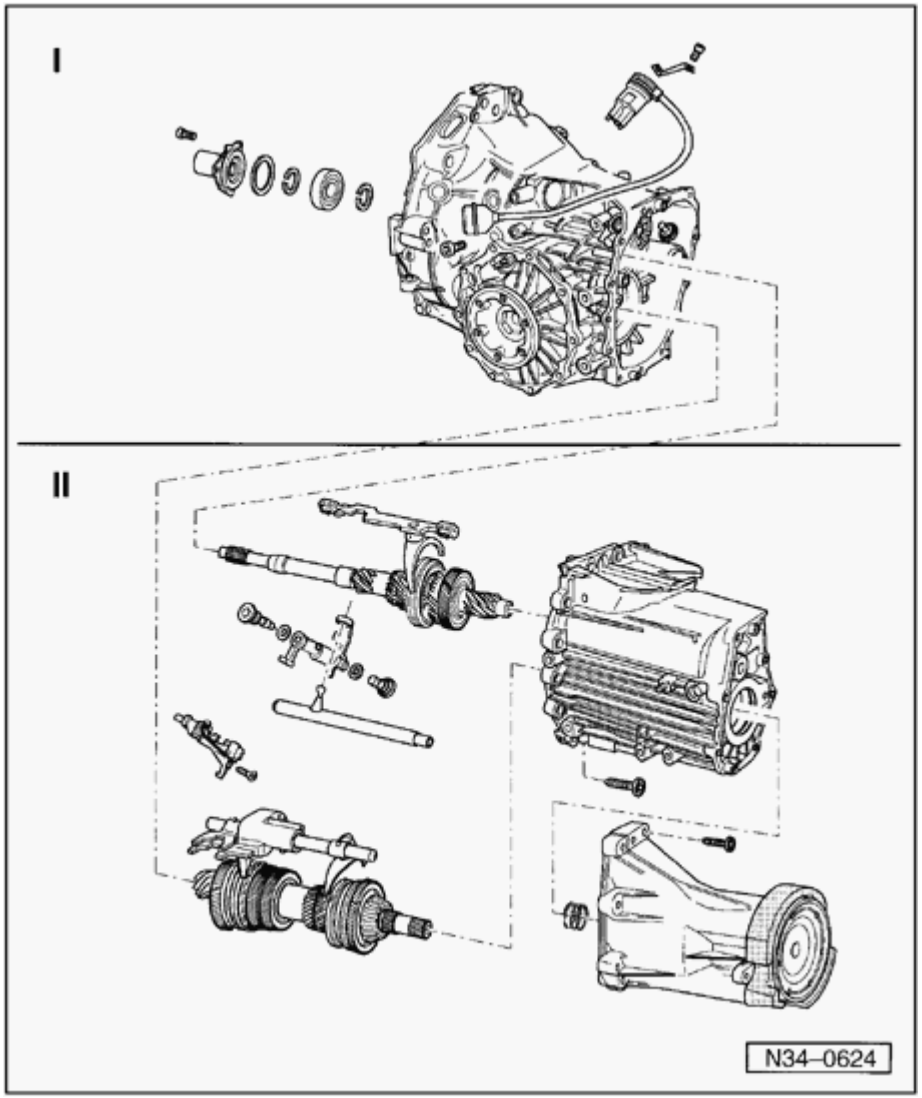
20 - Radial tapered roller bearing

- Adjusting ⇒ Page 39-39

21 - Hollow shaft

- Disassembling and assembling drive pinion and hollow shaft ⇒ Page 35-21

34-46

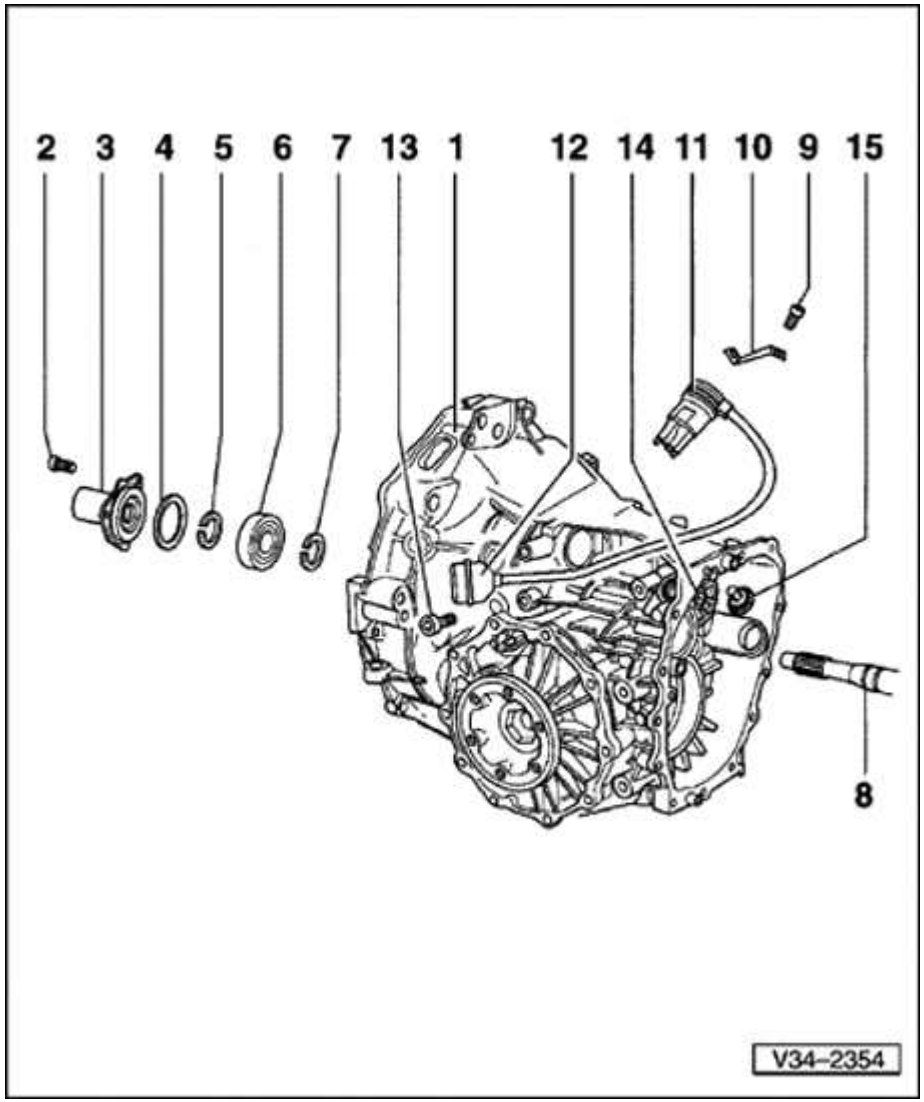


Assembly overview

I - Input shaft ball bearing and multi-function switch, removing and installing ⇒ Page 34-47

II - Input shaft, drive pinion, hollow shaft, selector rods, transmission cover and Torsen differential cover, removing and installing ⇒ Page 34-51

34-47



Input shaft ball bearing and multi-function switch, removing and installing

1 - Transmission housing

- With differential and flange shafts
- Removing and installing flange shafts ⇒ Page 39-1
- Removing and installing differential ⇒ Page 39-16
- Removing and installing speedometer Vehicle Speed Sensor (VSS) ⇒ Page 39-13
- Removing and installing speedometer drive gear ⇒ Page 39-14
- Breather installation position ⇒ Fig. 1

2 - Torx® bolt

- Always replace
- 35 Nm (26 ft lb)
- Self-locking

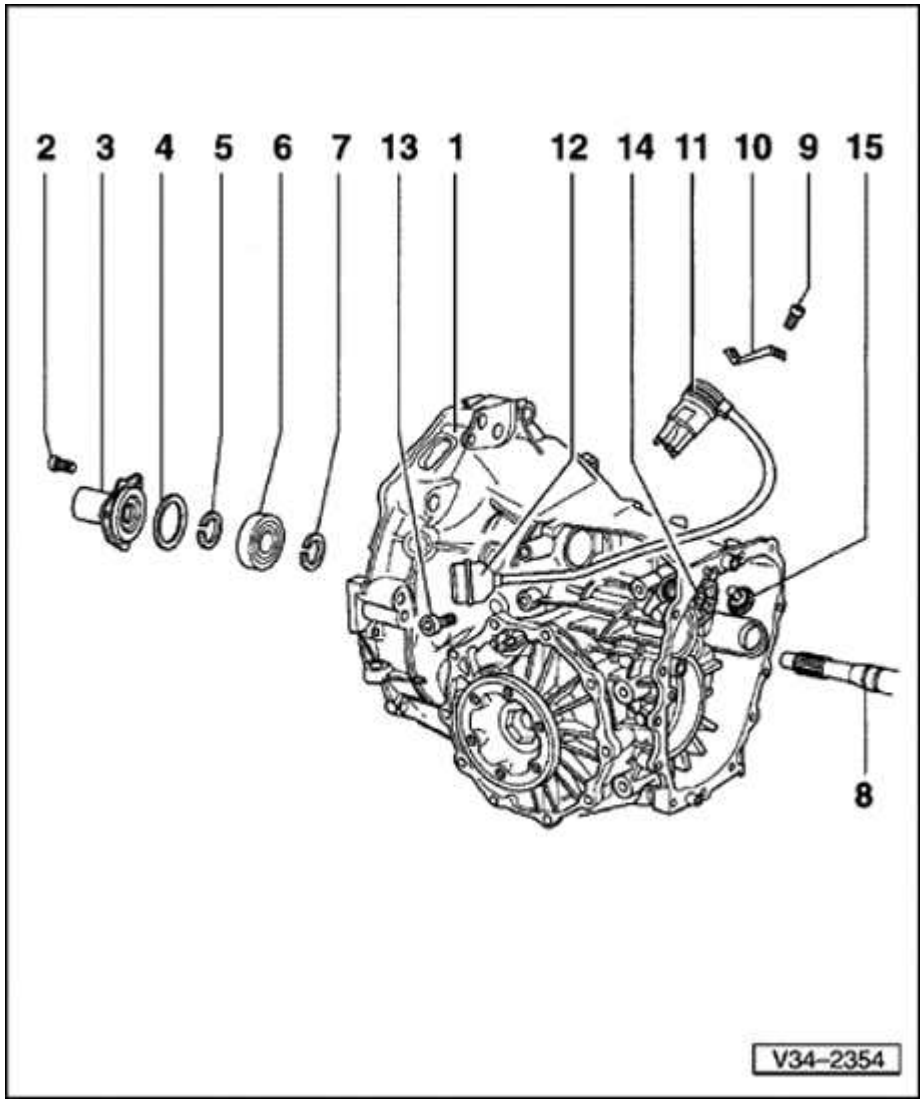
3 - Guide sleeve

- Installed with O-ring and seal for input shaft ⇒ Page 30-20

4 - Dished washer

- Smaller diameter (convex side) faces guide sleeve

34-48



5 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

6 - Input shaft ball bearing

- Removing and installing ⇒ Page 34-55

7 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

8 - Input shaft

- Removing and installing ⇒ Page 34-51
- Disassembling and assembling ⇒ Page 35-1
- Adjusting ⇒ Page 35-17
- Servicing input shaft ball bearing ⇒ Page 35-1

9 - Socket-head bolt

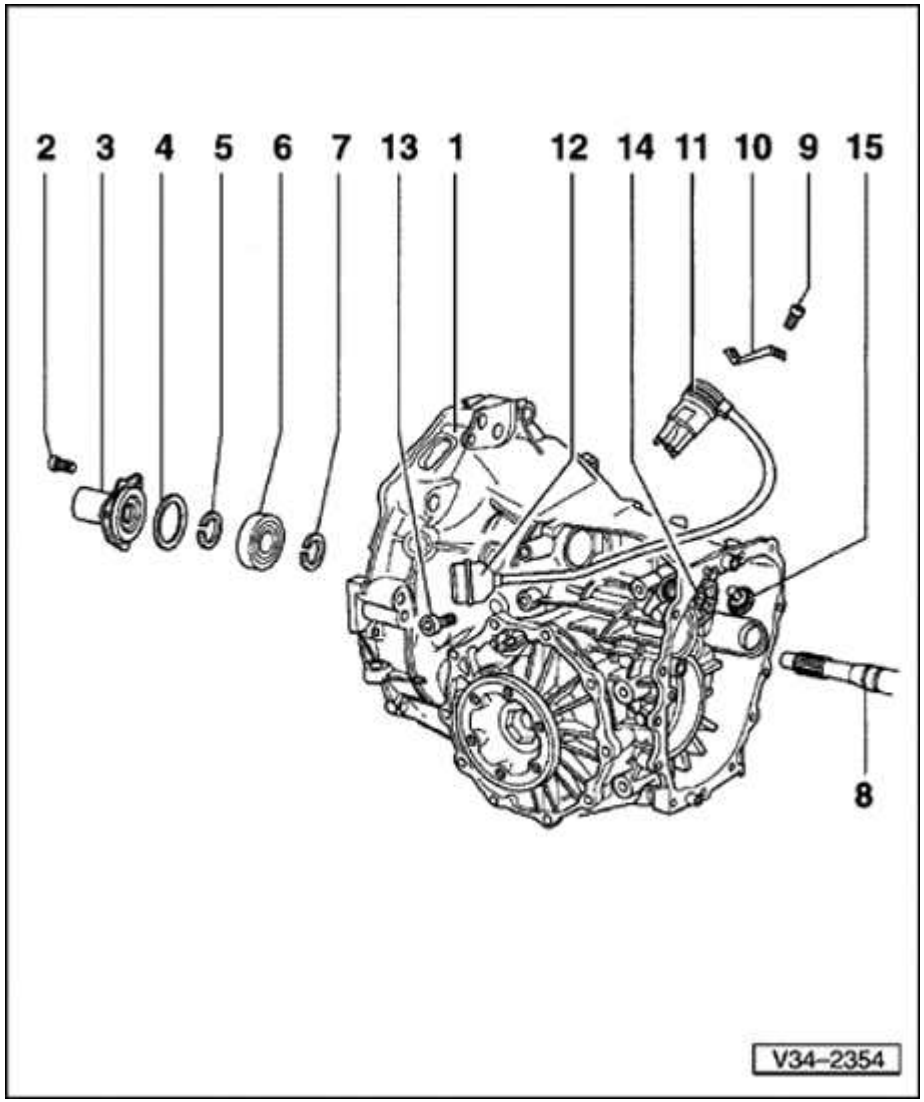
- 25 Nm (18 ft lb)

10 - Locking plate

- For multi-function switch

11 - Multi-function switch

34-49



12 - Multi-function switch harness connector

13 - Socket-head bolt

- 10 Nm (7 ft lb)

14 - Cover for shift rod

- Removing and installing ⇒ Page 34-79

15 - Gear lock for 5th and reverse gear

- Removing and installing ⇒ Page 34-86

34-50

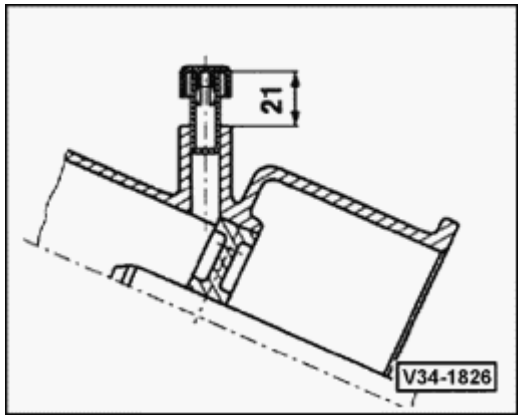
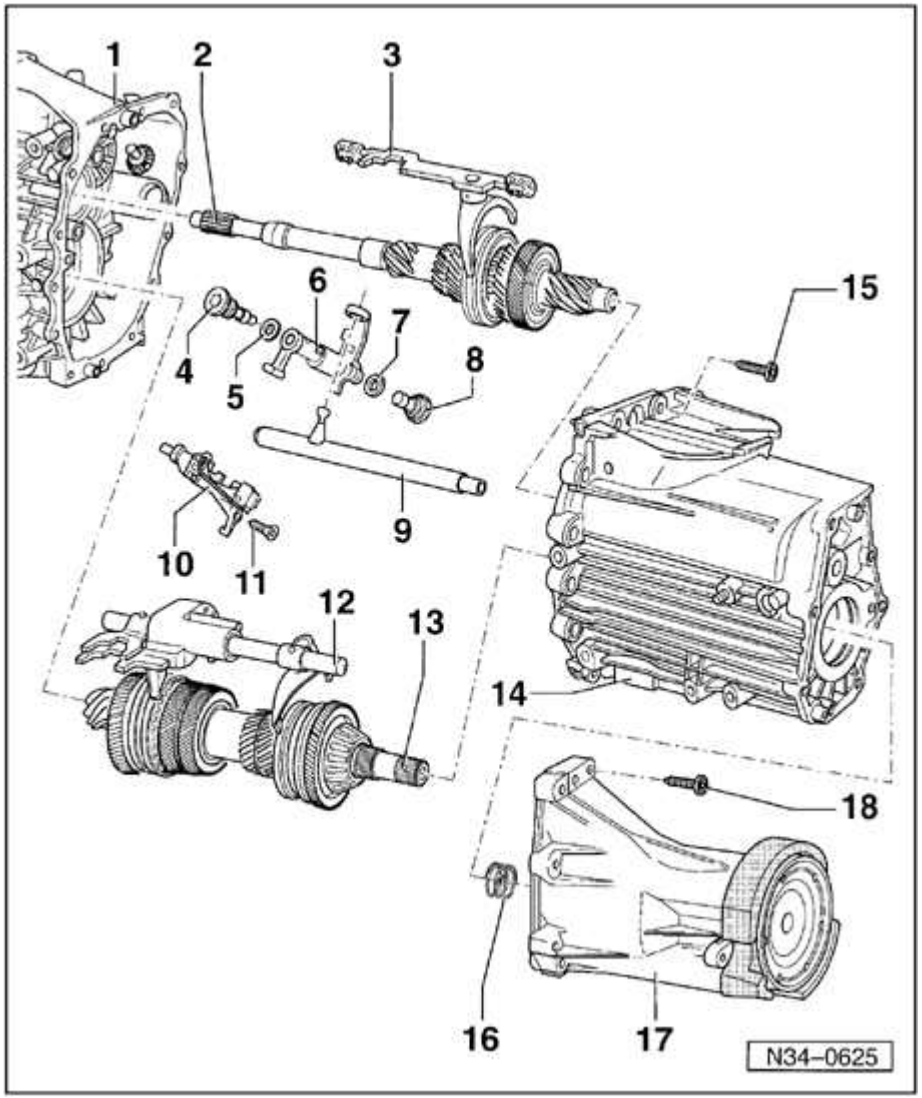


Fig. 1 Breather installation position

After pressing in, the breather must project 21 mm (0.827 in.) out of the housing .

34-51



Input shaft, drive pinion, hollow shaft, shift rods, transmission cover and Torsen differential cover, removing and installing

1 - Transmission housing

2 - Input shaft

- Disassembling and assembling ⇒ Page 35-1
- Adjusting ⇒ Page 35-17
- Servicing input shaft bearings ⇒ Page 35-1

3 - Shift rod with shift fork for 3rd and 4th gear

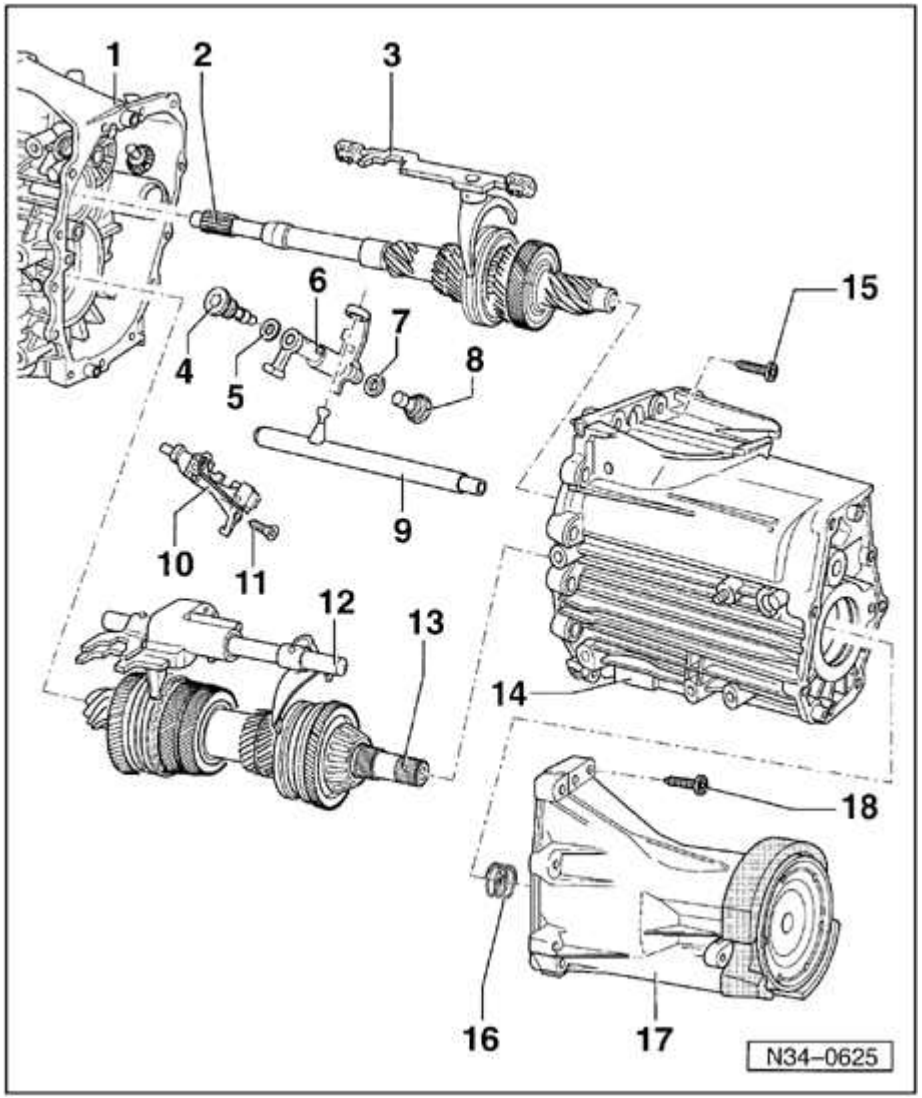
- Disassembling and assembling ⇒ Page 34-79
- Replacing bushings ⇒ Page 34-84

4 - Left stop bolt

- 40 Nm (30 ft lb)

5 - Sealing washer

34-52



6 - Relay shaft

- Installation position ⇒ Page 34-79

7 - Sealing washer

8 - Right stop bolt

- 40 Nm (30 ft lb)

9 - Shift rod

- Installation position ⇒ Page 34-79
- Replacing shift rod sealing washer ⇒ Page 34-79

10 - Shift detent

- Installation position ⇒ Page 34-79

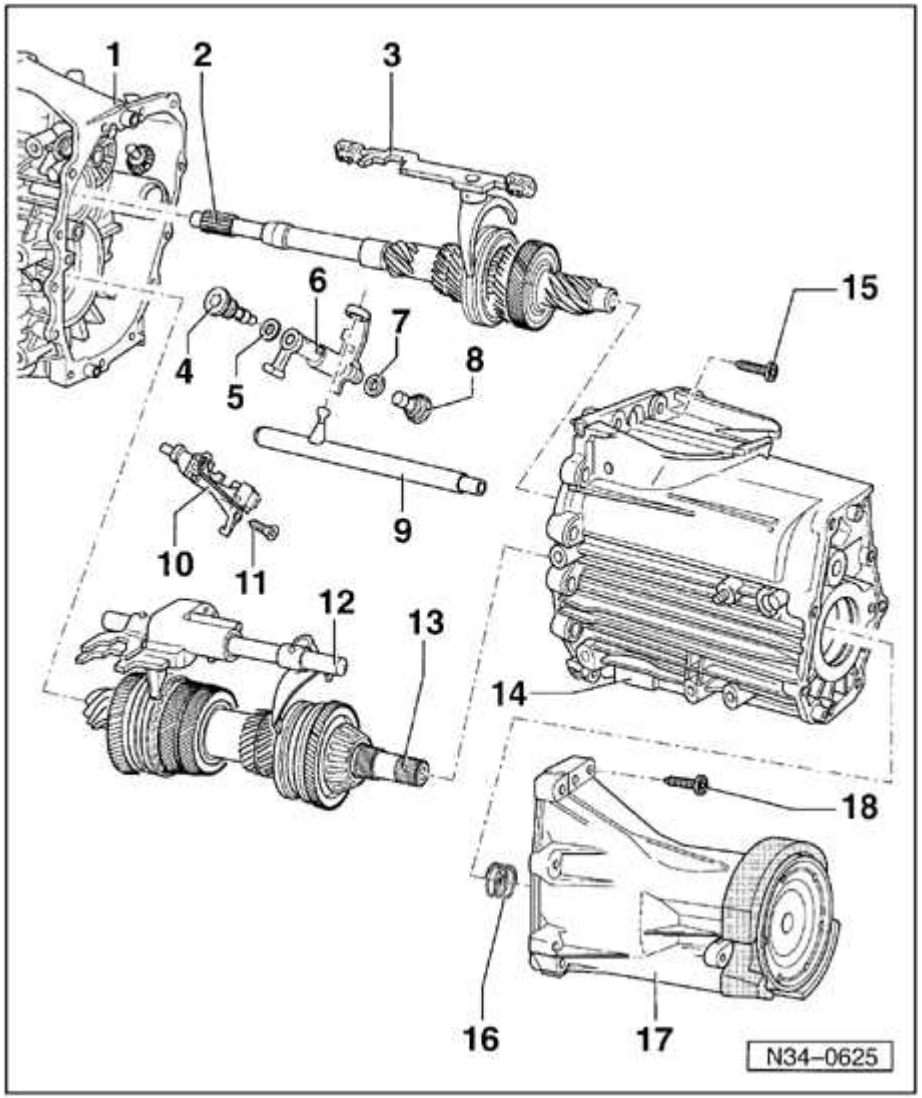
11 - Torx® bolt

- 25 Nm (18 ft lb)
- With shoulder to secure shift detent spring

12 - Shift rod with 1st/2nd/5th and reverse gear shift fork

- Disassembling and assembling ⇒ Page 34-79
- Removing and installing ball sleeve ⇒ Page 34-83

34-53



13 - Drive pinion with hollow shaft

- Disassembling and assembling ⇒ Page 35-21
- Adjusting ⇒ Page 39-34
- Servicing drive pinion and hollow shaft bearings ⇒ Page 35-21

14 - Transmission cover

- Removing and installing oil collector tray ⇒ Fig. 1

15 - Torx® bolt

- 22 Nm (16 ft lb)

16 - Compression spring

17 - Torsen differential cover

- Removing and installing with transmission installed ⇒ Page 34-39
- Removing and installing Torsen differential from cover ⇒ Page 34-68
- Servicing cover ⇒ Page 34-68

18 - Torx® bolt

- 22 Nm (16 ft lb)

34-54

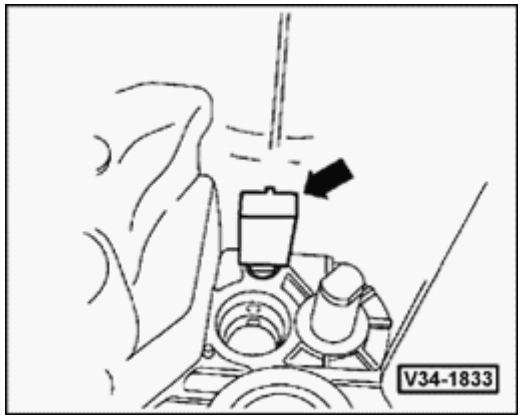


Fig. 1 Removing and installing oil collector tray

Removing

- Turn oil collector tray (arrow) and pull out.

Installing

- Push oil collector tray into transmission, until it snaps in.

  Oil collector tray faces upward in transmission cover.

34-55

Input shaft ball bearing, multi-function switch, input shaft, drive pinion, shift rods, transmission cover and Torsen differential cover, removing and installing

Notes:

- *To remove the above-mentioned components it is not necessary to remove the differential.*
- *Removal is only necessary when adjustments have to be performed* ⇒ *Page 39-37 , list of adjustments*

Special tools and equipment

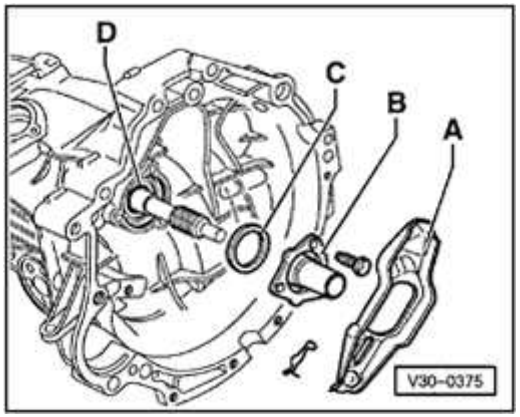
- VW309 holding plate
- VW353 transmission support
- 3235 press device
- VAG1306 drip tray
- VAG1582 taper roller bearing puller

- VAG1582/3 attachment to VAG1582

34-56

Removing

- Place drip tray below transmission.
- Drain gear oil.
- Secure transmission to assembly stand ⇒ Page 34-30 .



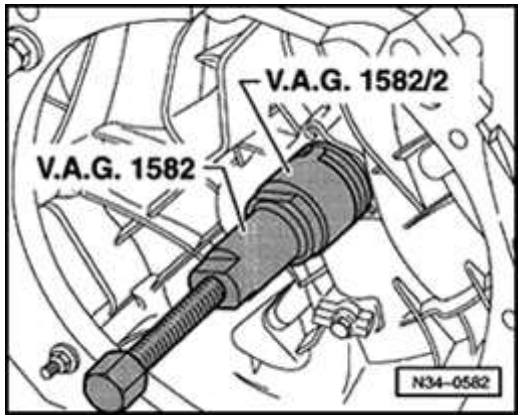
- Remove clutch release lever -A- with release bearing.

Notes:

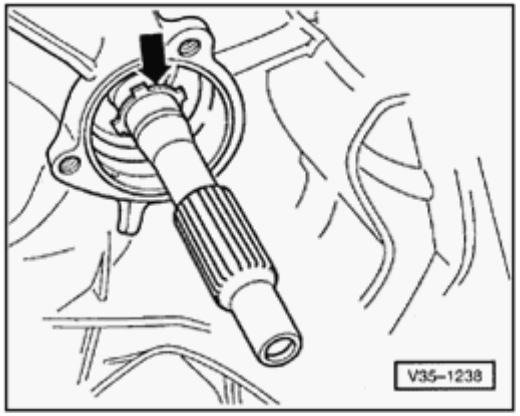
- *Before removing the guide sleeve, slide a shrink tube over the input shaft splines to protect the seal.*
- *Remove the seal in the guide sleeve ⇒ Page 30-20 .*

- Remove guide sleeve -B-.
- Remove dished washer -C-.
- Remove circlip -D- in front of input shaft ball bearing.
- Note thickness of circlip, if ball bearing, drive axle or transmission housing is not replaced.

34-57

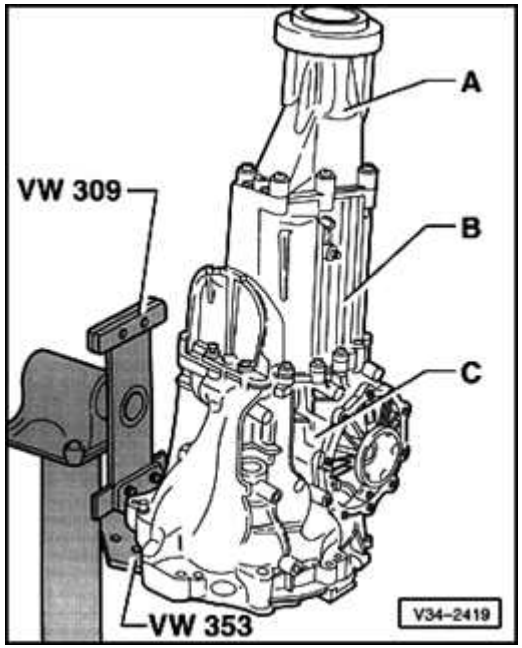


- Pull input shaft ball bearing out of transmission housing.

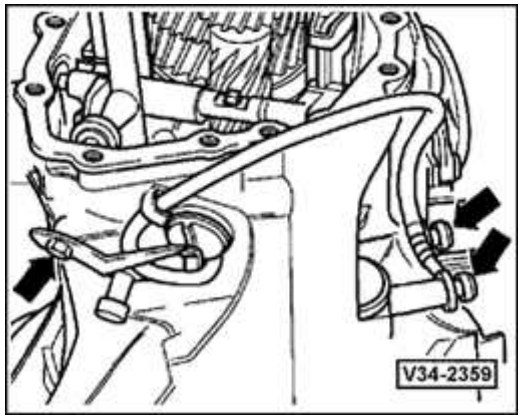


- Remove circlip (arrow) behind input shaft ball bearing.
- Note thickness of circlip, if ball bearing, drive axle or transmission housing are not replaced.

34-58

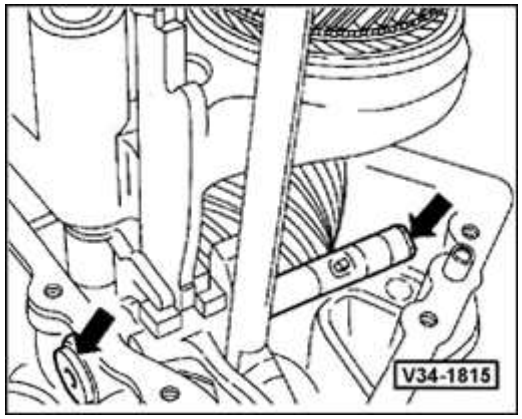


- Remove cover -A- together with Torsen differential from transmission cover -B-.
- Remove compression spring from drive pinion.
- Remove transmission cover -B- from transmission housing -C-.

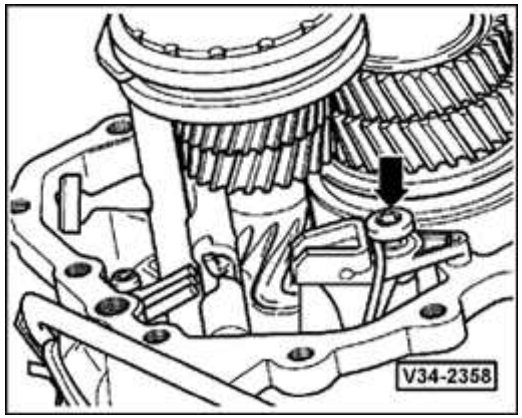


- Remove bolts (arrows) and pull out multi-function switch.

34-59

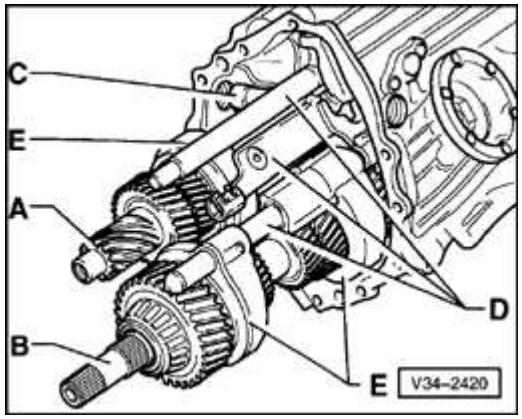


- Remove relay shaft stop bolts (arrows) items 4, 8 ⇒ Page 34-51 , and ⇒ Page 34-52 .



- Unbolt shift detent (arrow) and swing it out.

34-60

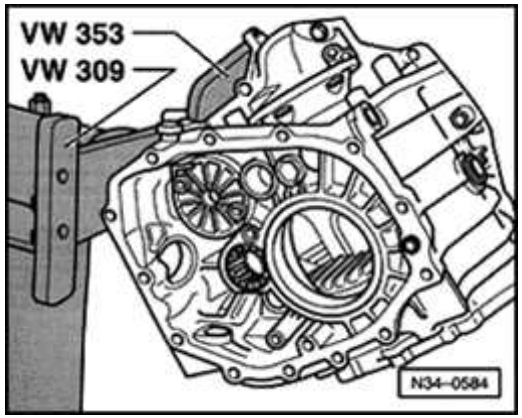


- Input shaft -A-, drive pinion -B-, relay shaft -C-, selector rods -D- with shift rod and selector forks -E- must all be carefully pulled out together.

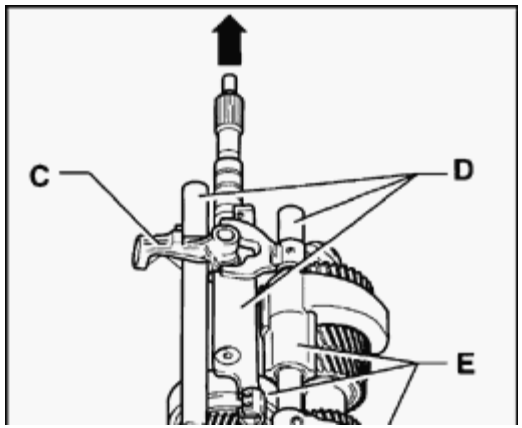
Installing

Note:

If the input shaft ball bearing, the input shaft or the transmission housing are replaced, it is necessary to re-determine the thickness of the circlips for the input shaft first, input shaft, adjusting ⇒ *Page 35-17* .



- For easier installation of following components, swing transmission housing into position shown.

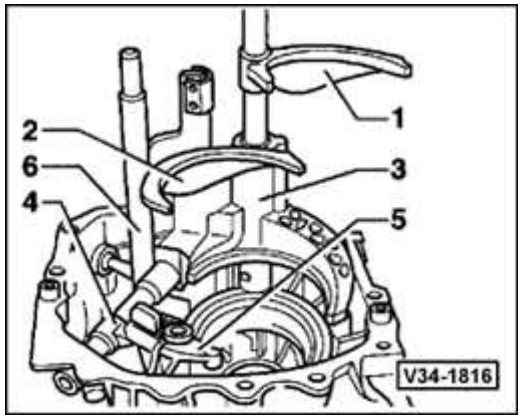


- Assemble input shaft -A-, drive pinion -B-, relay shaft -C-, selector rods -D- with shift rod and selector forks -E-.
- Install these components into transmission housing as a set.

Note:

The relay shaft -C- and the shift rod can also be installed later if necessary ⇒ *Page 34-62* , *Illustration V34-1816 and* ⇒ *Page 34-63* , *illustration V34-2120*

34-62



➢ Position of shift mechanism in transmission.

1 - Shift fork 5th and reverse gears

2 - Shift fork 3rd and 4th gears

3 - Shift fork 1st and 2nd gears

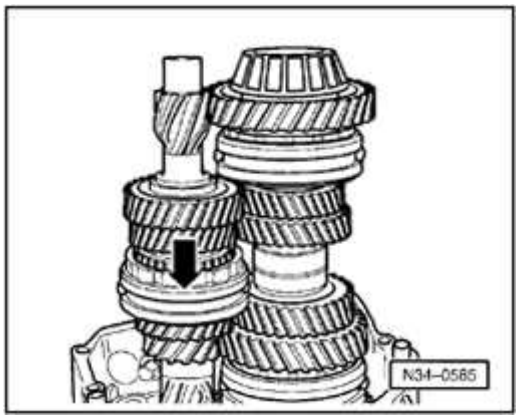
4 - Relay shaft

5 - Shift detent

6 - Shift rod

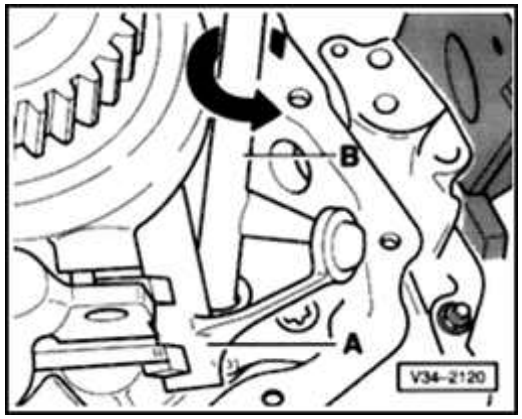
Note:

Illustration is shown without the drive axle and pinion.

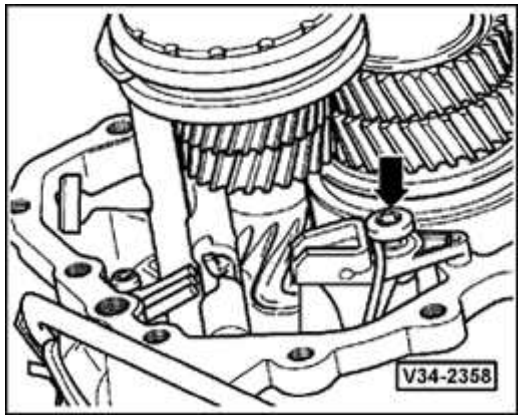


➢ - Move transmission housing and engage 3rd gear (direction of arrow).

34-63

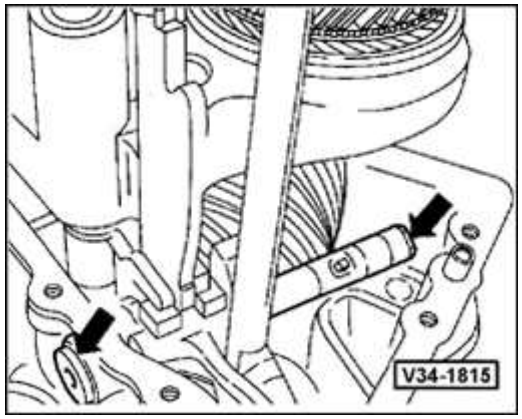


- Install relay shaft -A-.
- Place inner shift rod -B- sideways into mounting hole in transmission housing and assemble into mounting eye.
- Carefully turn shift rod in direction of arrow.

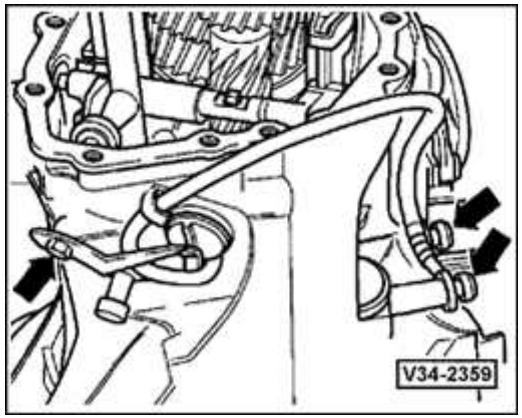


- Insert shift detent and tighten bolt (arrow) securely.

34-64

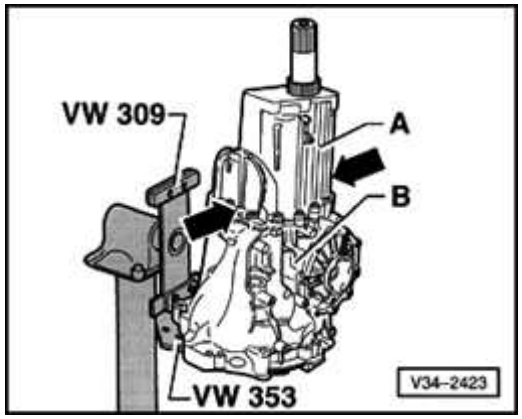


- Install relay shaft stop bolts (arrows).
- Replace O-ring for multi-function switch.

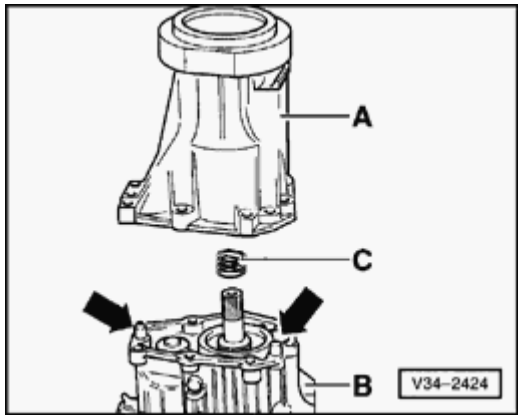


- Carefully insert multi-function switch and tighten (arrows).

34-65

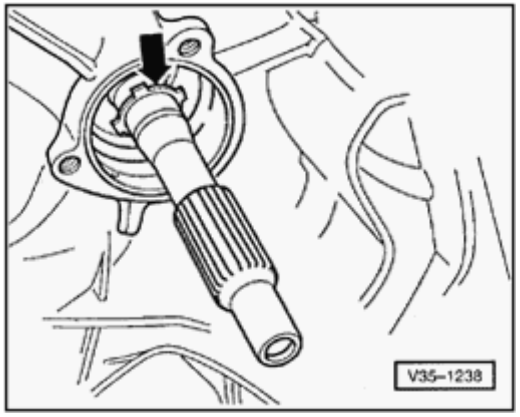


- Make sure dowel sleeves for transmission cover -A- are installed in transmission housing -B- (arrows).
- Install transmission cover onto transmission housing.



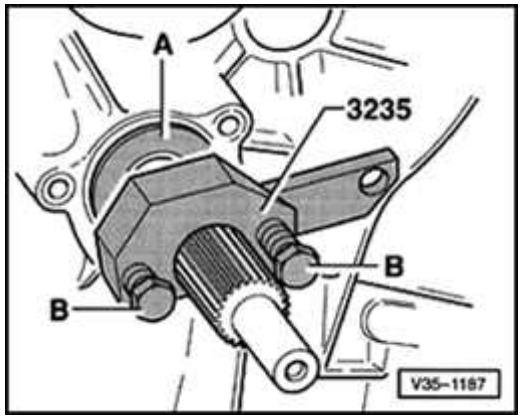
- Make sure dowel sleeves for cover -A- are installed in transmission cover -B- (arrows).
- Install compression spring -C-.
- Install Torsen differential cover -A- onto transmission cover -B-.

34-66



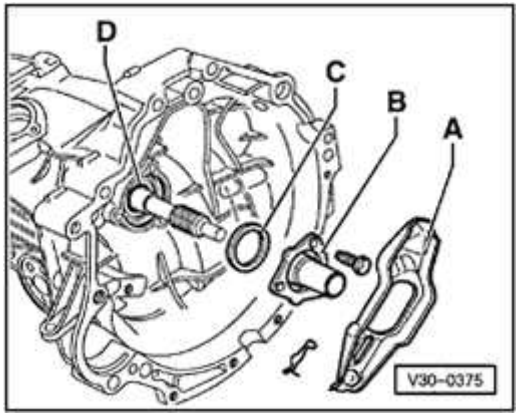
- Install rear circlip (arrow) for ball bearing onto input shaft.
- Slide ball bearing onto input shaft.

  Closed side of ball cage faces toward transmission housing.



- Press in ball bearing.
- Slide thrust piece -A- of press device onto input shaft.
- Position press device behind splines for clutch plate.
- Screw in bolts -B- and tighten slightly.

  The bolts bear against the indentations in thrust piece -A-.
- Press in ball bearing onto seat by alternately tightening bolts -B- (1/2-turn at a time) until stop is reached.



- Install front circlip -D- for input shaft ball bearing.
- Install dished washer -C-.

  Position: convex side faces guide sleeve -B-.

Notes:

- *Before installing guide sleeve, cover splines on input shaft with a shrink-fit hose to protect the seal.*
- *Installing seal in guide sleeve* ⇒ *Page 30-20* .

- Install guide sleeve -B- for clutch release bearing.
- Install clutch release lever -A- and clutch release bearing.

Bearing housing, Torsen differential, end cover, internal selector mechanism, input shaft, drive pinion and hollow shaft, removing and installing (assembly sequence)

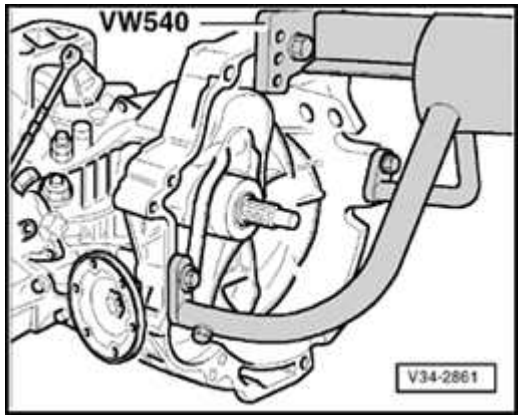
Special tools, testers and auxiliary items required:

- Engine and transmission support VW 540
- Drip tray V.A.G 1306
- Multi-purpose tool 771/1 with attachments 771/15, 771/37 and stud M8/ M10
- Two-arm puller e.g. Kukko 20/10 with 200 mm long hooks
- Mandrel 2064
- Clamping sleeve 3116
- Thrust piece 3118

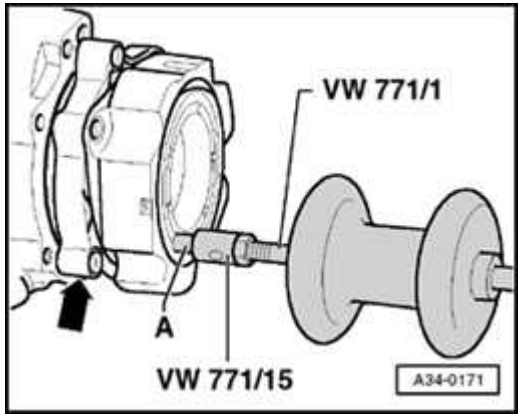
- Drift 3121
- Internal puller 3275
- Pressing tool 3276

- Thrust plate VW 402
- Press tool VW 407
- Press tool VW 412
- Tube VW 415a
- Thrust plate VW 447h
- Thrust pad VW 454
- Extractor lever VW 681
- Extension piece 30-23
- Drift sleeve 30-100
- Support bridge 30-211A
- Press tool 40-21
- Depth gauge

Removing

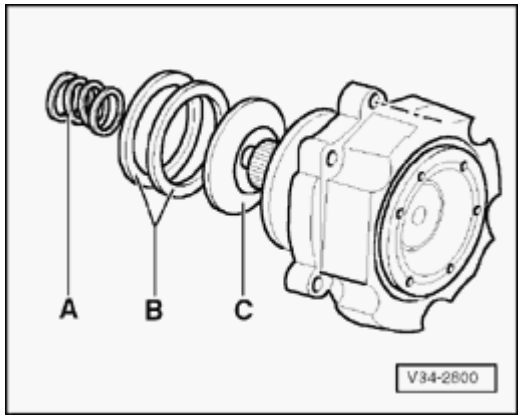


- Secure transmission on engine and transmission support VW 540.
- Place drip tray V.A.G 1306 underneath and drain transmission oil (2 oil drain plugs).
- Remove release bearing, clutch release lever and guide sleeve ⇒ Page 30-27 .



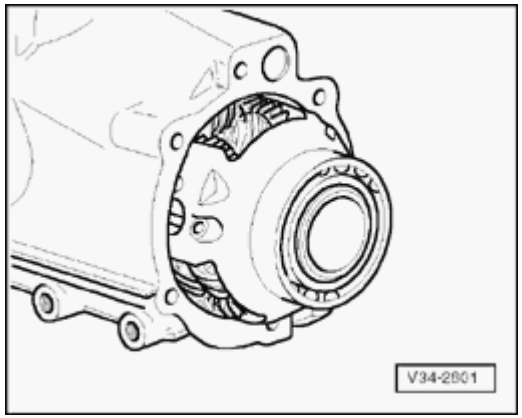
- Remove bearing housing (arrow) and pull off.

A - M8/M10 stud

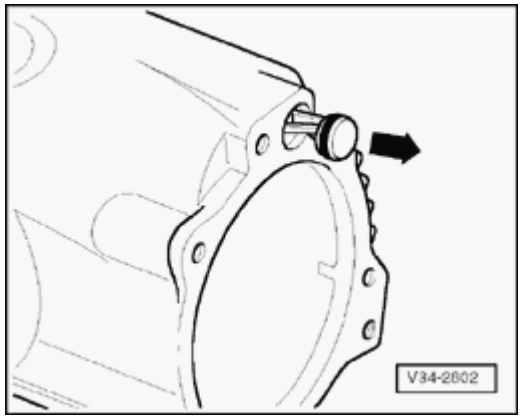


➢ When pulling off, bearing housing is pressed slightly off end cover by spring -A-.

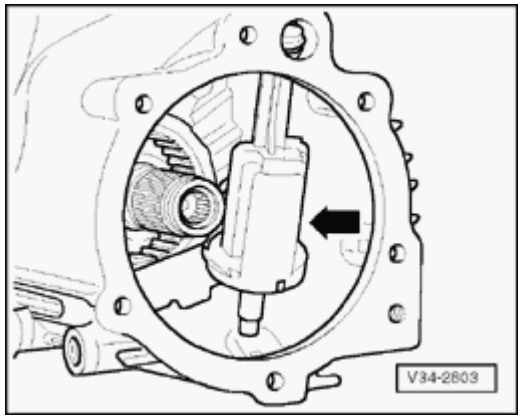
- Note position of spring plate -C- when removing bearing housing.
  - ♦ Outer diameter (concave side) towards shims
- Remove shims -B-, note thickness re-determine if necessary ⇒ Page 34-85 .



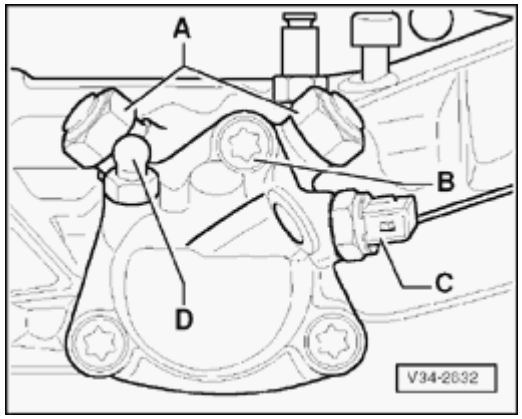
➢ - Pull Torsen differential out of end cover.



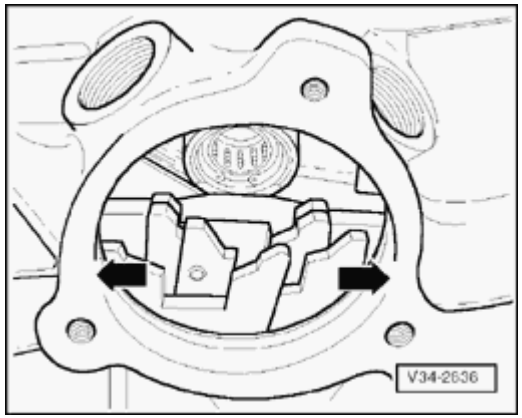
- Pull oil collector out of end cover (arrow) until it moves freely.



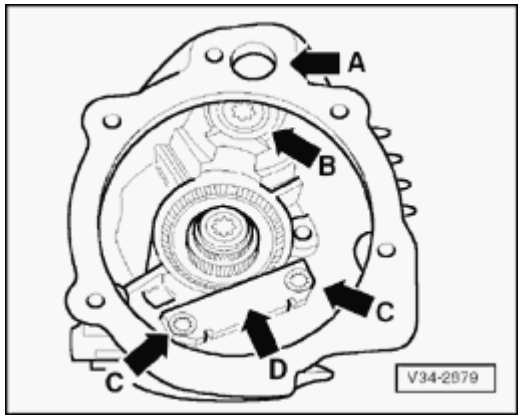
- Swing oil collector (arrow) down and guide out through hole in end cover.
- Remove oil collector.



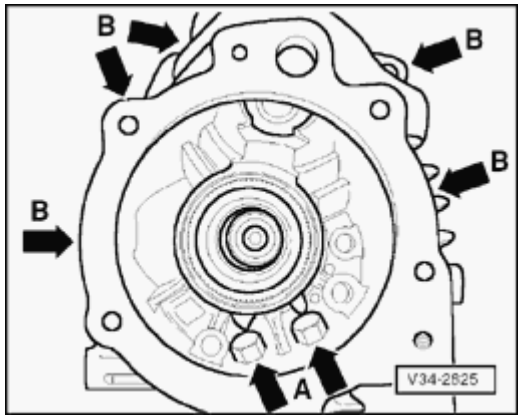
- Remove locking bolts -A- for selector shaft from transmission housing.
- Mark installation positions of aluminium bolts and steel bolts; do not interchange.
- Remove 3 bolts -B- for cover for selector shaft, take off cover.
- Pull out selector shaft.



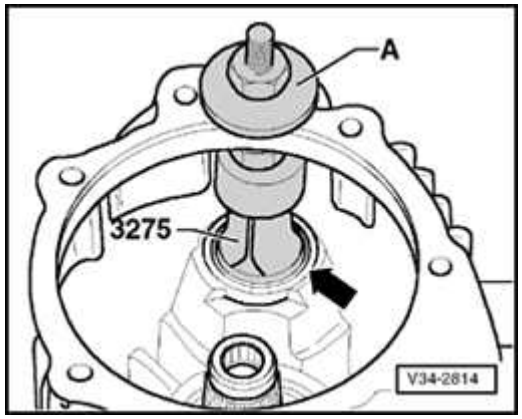
- Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear) do this by moving 2 selector plates (arrows).



- Loosen and unscrew multi-point socket head bolt (arrow -B-) in input shaft through hole (arrow -A-) in end cover.
- Remove 2 securing bolts (arrow -C-) for end cover for transmission at supporting plate for needle bearings -arrow D-.
- Take out supporting plate.



- Remove 2 magnets (arrows -A-) and clean.
- Loosen 5 bolts (arrows -B-) for securing end cover for transmission and remove.



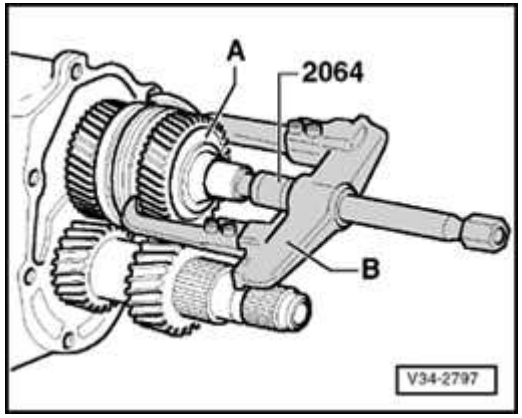
- Pull 2nd inner race for ball bearing for input shaft from input shaft.

A - Washer

Note:

The internal extractor 3275 grips the circumferential groove of the inner race (arrow) during the pulling operation.

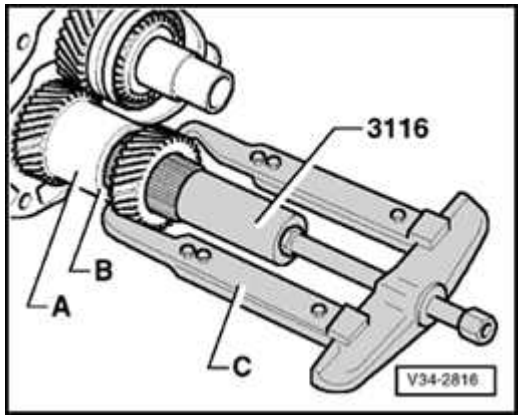
- Take off end cover together with end cover/bearing plate gasket.
- Pull dowel sleeves out of bearing plate.



- Pull off 5th speed sliding gear with spring together with 1st inner race - A- for ball bearing for input shaft.

B - Two arm puller, e.g. Kukko 20/10

- Take off 5th gear synchro-ring.
- Take off circlip for 5th speed gear.



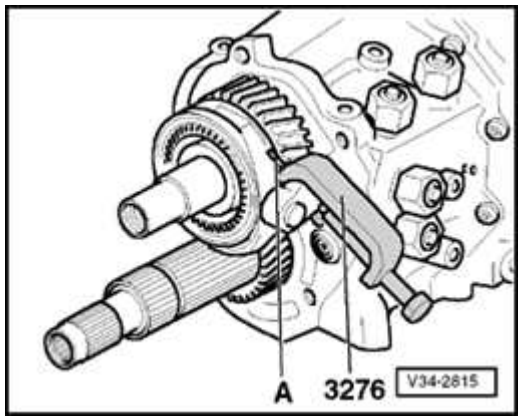
- Pull off 5th speed gear, to do this, block hollow shaft by engaging 2 gears ⇒ Page 34-59 .

Note:

Use only hex bolt of tensioning sleeve 3116, length 50 mm.

C - Two arm puller, e.g. Kukko 20/10 with 200 mm long puller arms

- Remove shim -B- for 5th speed gear, note thickness and re-determine if necessary ⇒ Page 34-78 .
- Take off spacer sleeve -A-.

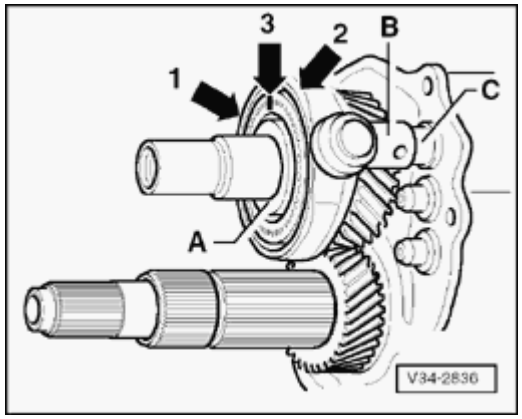


- Press out roll pin -A- for selector fork for 5th and 6th gear.

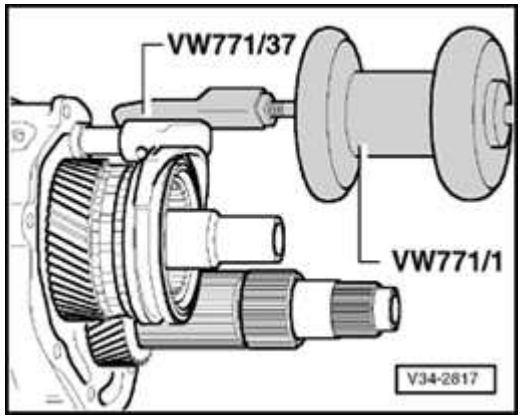
Note:

Do not drive out roll pin, otherwise selector rod bearing will be damaged.

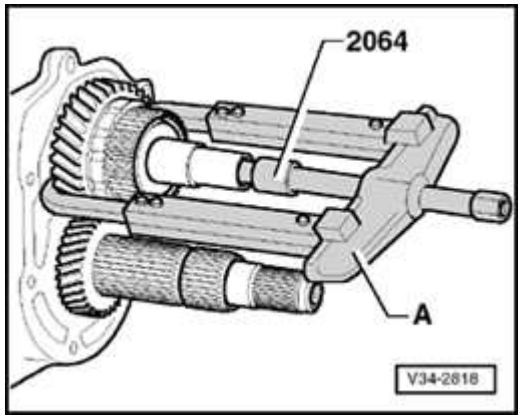
- Pull selector rod on follower together with selector fork for 5th and 6th gear and locking collar as far as possible away from bearing plate (until stop is felt).



- Mark installation position (arrow -3-) of locking collar for 5th and 6th gear (arrow -1-) and synchro-hub -A- (paired).

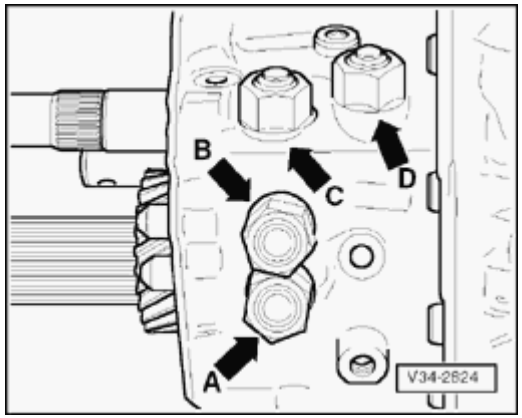


- Pull follower together with selector fork and locking collar off selector rod.



- Pull off 6th speed sliding gear, synchro-ring for 6th gear, synchro-hub for 5th and 6th speed gears and inner race for 5th speed sliding gear.

A - Two arm puller, e.g. Kukko 20/10 with 200 mm long hooks



- Unscrew selector rod locking bolts.

A - 1st and 2nd gear

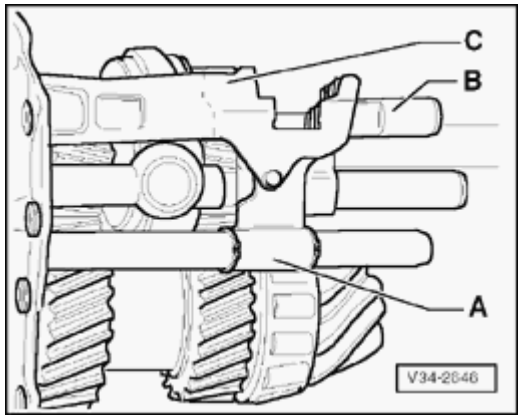
B - 3rd and 4th gear

C - 5th and 6th gear

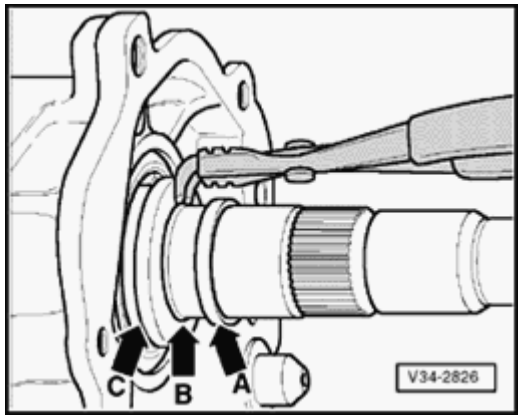
D - Reverse gear

- Mark fitting locations of aluminium and steel bolts. (Bolts must not be interchanged when installing.)
- Drive out dowel sleeves on bearing plate and remove bearing plate from transmission housing.
- Secure drive pinion relative to hollow shaft e.g. hose tie, to prevent it falling out.

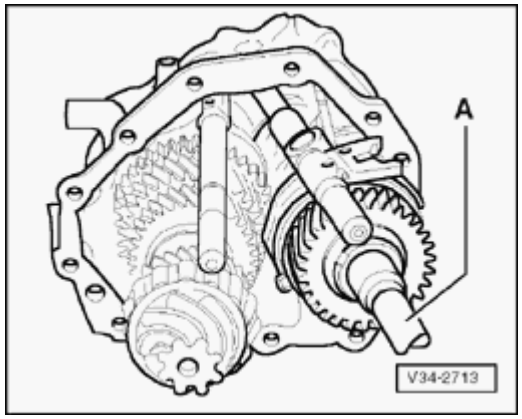
- Separate bearing plate with input shaft, with drive pinion and hollow shaft and with inner selector mechanism from transmission housing.



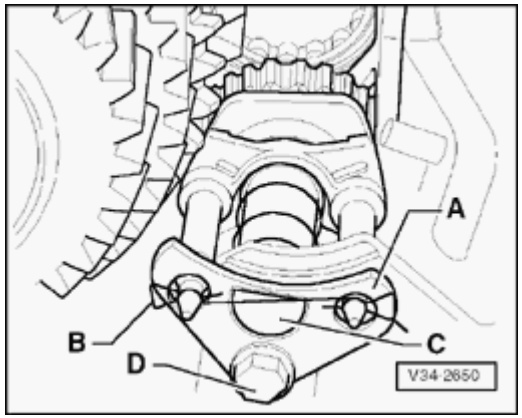
- Remove circlip from selector rod for 1st and 2nd gear and take off follower -A-.
- Pull out selector rod -B- for 5th and 6th gear.
- Remove follower -C- for reverse gear.



- Pull thrust washer (arrow -A-) for needle bearing for 6th gear off shaft.
- Use right-angled circlip pliers to remove circlip (arrow -B-) for inner race for cylinder roller bearing.
- Take out inner race (arrow -C-) for cylinder roller bearing (not a press fit).



- Take input shaft -A- with selector rod and selector fork for 3rd and 4th gear out at an angle from bearing plate.



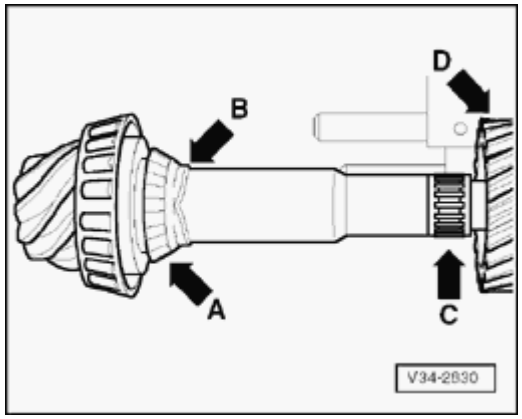
- Unscrew hex bolt -D-, take off spring clasp -B- and retaining plate -A-, pull out shaft -C- for reverse idler gear.
- Take out spring, synchro-ring and reverse idler gear.
- Take off relay lever for reverse gear.

Removing and installing reverse gear ⇒ Page 34-114 .

Note:

- *Drive pinion and hollow shaft can be removed complete if the 6th speed gear can be easily pried off.*
- *If it is necessary to press off the 6th speed gear, the drive pinion must be pulled out of the hollow shaft.*

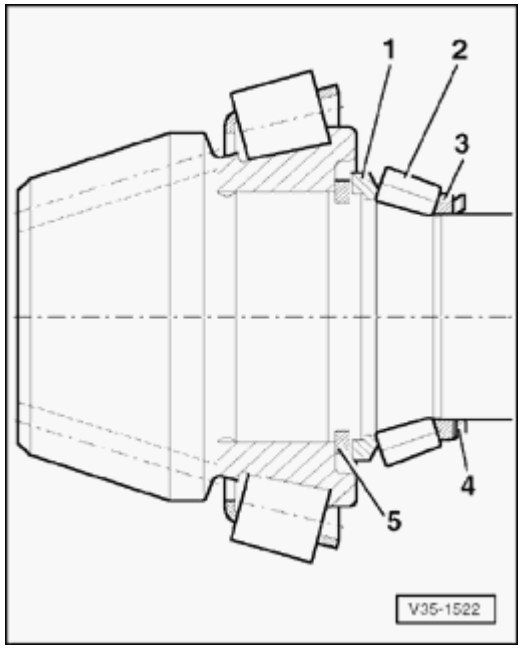
- Remove drive pinion circlip.



- Pull drive pinion out of hollow shaft -D-, when doing this catch tapered rollers -A- (Qty. 23).
- Take off corrugated spring -B- and needle ring -C-.

Note:

Carefully protect bearings from dirt, clean if necessary.



- Check bearing to ensure it is complete:

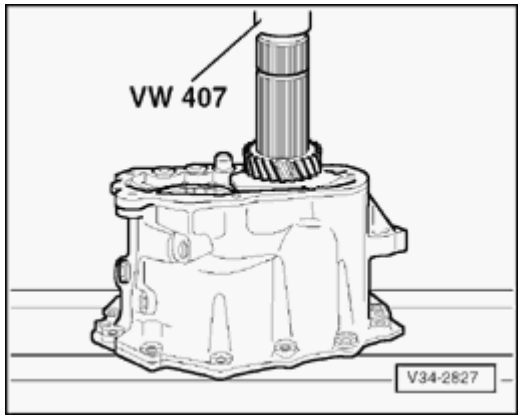
1 - Flange ring (tapered contact surface to tapered rollers)

2 - Tapered rollers (Qty. 23) with larger diameter facing towards drive pinion head

3 - Support ring (tapered contact surface to tapered rollers)

4 - Corrugated spring

5 - Circlip for tapered roller bearing for drive pinion



- Press off 6th speed gear.

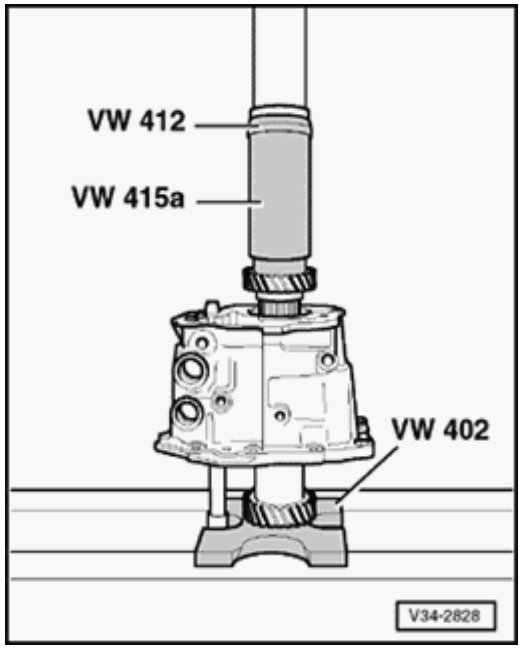
Note:

Because of the type of fit, it may be possible to press gear off easily.

- Take hollow shaft or drive pinion and hollow shaft with selector rod and selector fork for 1st and 2nd gear out of bearing plate.

Installing

- Fit hollow shaft with selector fork and selector rod for 1st and 2nd gear (without follower) into bearing plate.

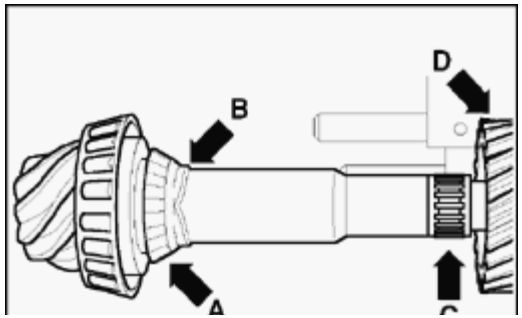


- Heat 6th gear to approx. 120 ° C and fit on.

  Installation position: shoulder towards tapered roller bearing

- Press onto stop; ensure there is no play.
- Grease drive pinion/hollow shaft tapered roller bearing with multi-purpose grease before inserting.

  Allocation ⇒ Page 34-68



A - Flange ring, tapered rollers (Qty. 23), and support ring

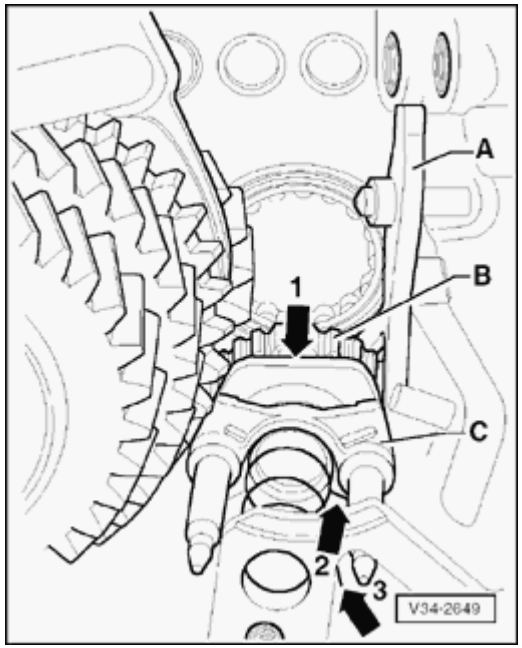
B - Corrugated spring

C - Needle ring

D - Hollow shaft

- Oil needle bearing well.

- Insert drive pinion into hollow shaft and secure with hose clip to prevent it slipping out.

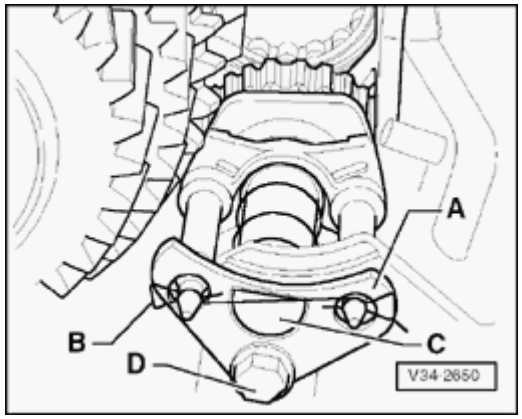


- Fit relay lever -A- for reverse gear onto bolt for relay lever. Watch position of pin when doing this (limits relay lever travel to synchro-ring).
- Insert sliding gear -B- and engage relay lever with groove on sliding gear.
- Insert synchro-ring -C-.

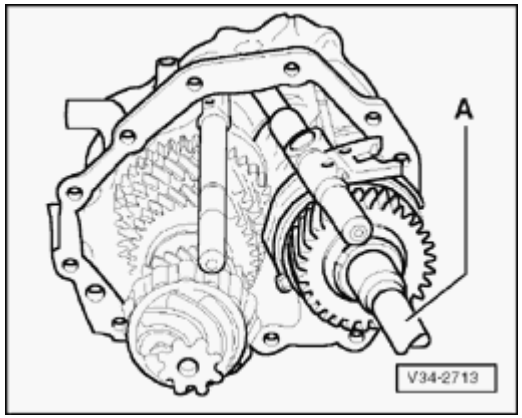
  Installation position: position flat on circumference of synchro-ring towards input shaft (not as yet fitted) (arrow -1-)

- Insert spring.

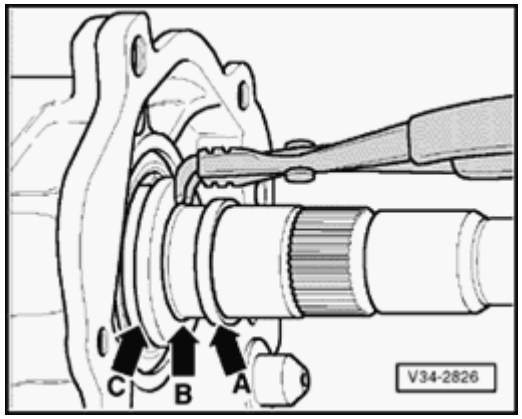
  Installation position: hook single angled end into recess on synchro-ring (arrow -2-). Turn double angled end anti-clockwise and hook into opening in bearing plate (arrow -3-)



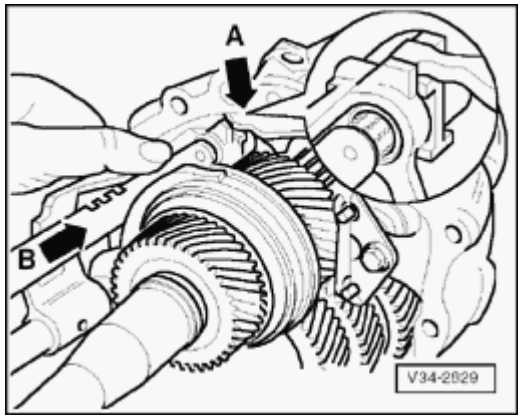
- Insert shaft -C-.
- Fit retaining plate -A-.
  - Installation position: chamfers of holes for locking pins of the synchro-ring face bearing plate
- Insert spring clasp -B- into locking pins of the synchro-ring.
- Replace self-locking nut -D- and tighten to 25 Nm.



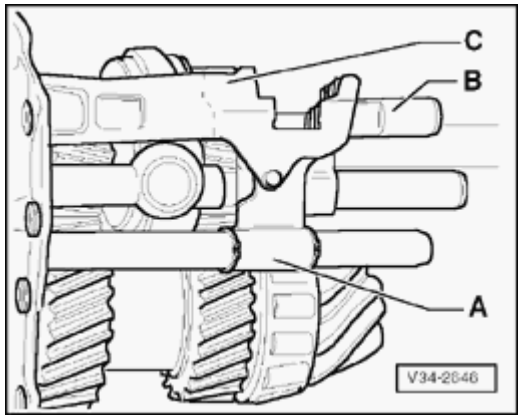
- Slide input shaft -A- with selector rod and selector fork for 3rd and 4th gear at an angle into bearing plate.
  - Selector fork installation position: rib towards follower ⇒ Page 34-52



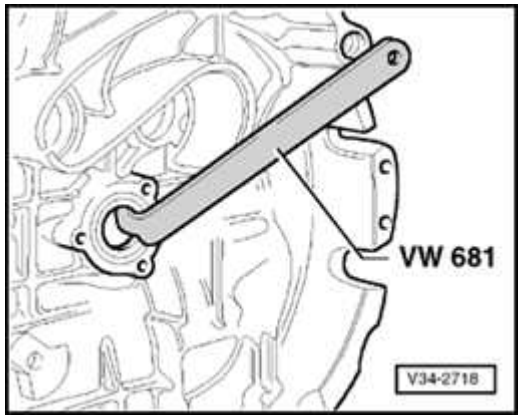
- Slide inner race (arrow -C-) for cylinder roller bearing onto main shaft at flange for end cover (clearance fit).
- Fit circlip (arrow -B-) using right-angled circlip pliers.



- Engage recess in follower for reverse gear with the free end of relay lever (arrow -A-).
- Slide selector rod for 5th and 6th through follower for reverse gear in direction of (arrow -B-).



- Slide follower -A- for 1st and 2nd gear onto selector rod and secure with circlips.
- Oil all bearings of input shaft and drive pinion/hollow shaft in transmission housing and bearing flange as well as selector rods with gear oil.



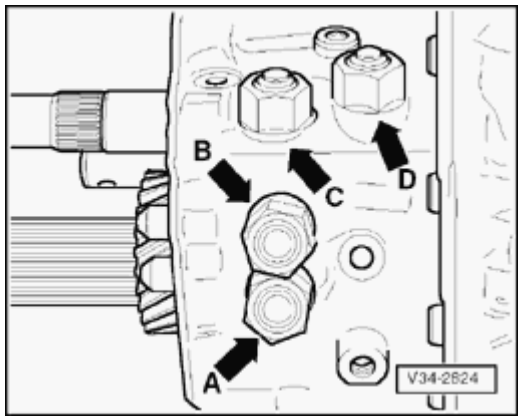
- Pry used seal for input shaft carefully out of transmission housing with VW 681.
- Coat sealing surfaces between bearing plate and transmission housing with sealing paste AMV 188 000 02 or AMV 188 001 02 sealing paste.
- Insert complete bearing plate into transmission housing.

Note:

When inserting the complete bearing plate, ensure that the selector rods align with their mounting points.

- Drive in 2 dowel sleeves for bearing flange/transmission housing.

- Tighten 12 bolts using diagonal sequence to 25 Nm.



- Screw in locking bolts for selector rods.

A - 1st and 2nd gear

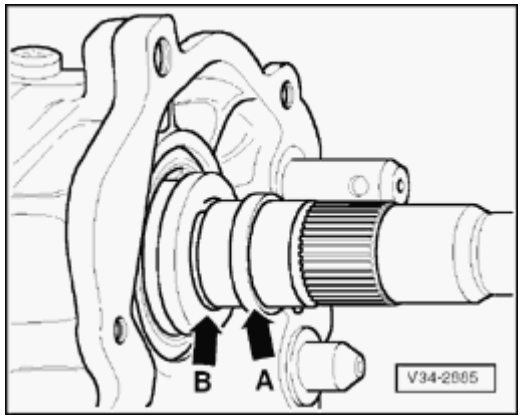
B - 3rd and 4th gear

C - 5th and 6th gear

D - Reverse gear

Note:

- *Aluminium and steel bolts must not be interchanged when installing.*
- *Tightening torques: for aluminium locking bolts = 50 Nm, and for steel locking bolts = 70 Nm*

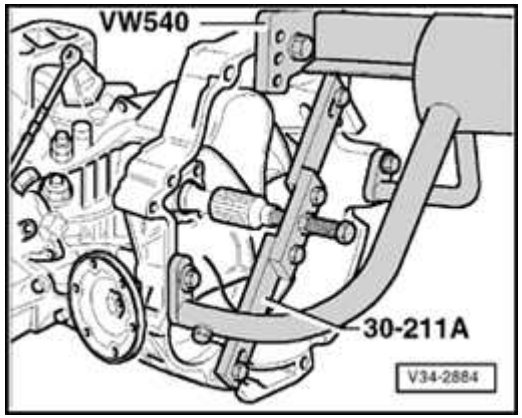


- Fit thrust washer (arrow -A-) for needle bearing for 6th speed gear.

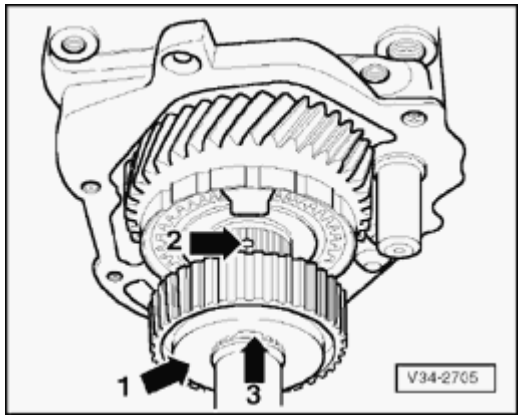
  Installation position: shoulder towards circlip (arrow -B-), smooth contact surface to shaft end

- Oil needle bearing for 6th speed sliding gear with gear oil and fit.
- Slide on 6th speed sliding gear with spring and synchro-ring.

  Synchro-ring installation position: the lugs of the synchro-ring engage into the recesses below in the sliding gear

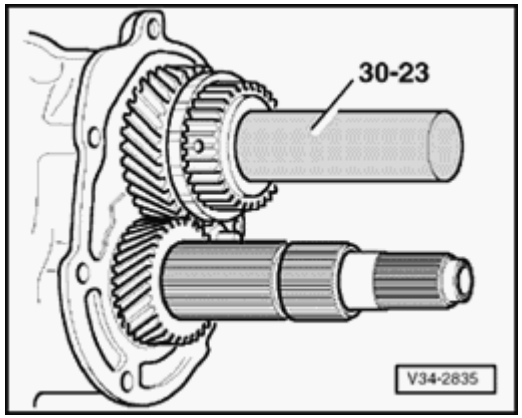


- Support input shaft with support bridge 30-211 A.



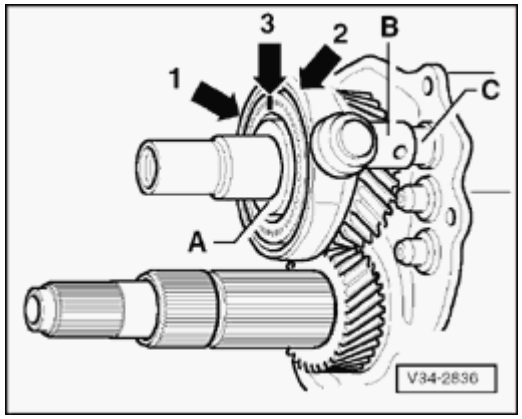
➢ Installation position of synchro-hub for 5th and 6th gear:

- Side with projecting face (arrow -1-) faces shaft end
- The oil drilling of the input shaft (arrow -2-) and the oil groove of the synchro-hub (arrow -3-) are in line



➢

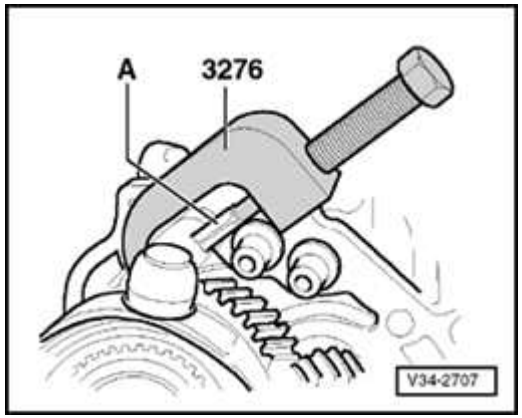
- Heat synchro-hub for 5th and 6th gear to approx. 100 ° C, fit and drive on; ensure there is no play.
- Check 6th speed sliding gear for axial play.



- Line up markings (arrow -3-) on paired synchro-hub -A- and locking collar for 5th and 6th gear (arrow -1-).
- Fit locking collar (arrow -1-) with selector fork (arrow -2-) onto synchro-hub -A- as well as follower for 5th and 6th gear -B- onto selector rod -C- at the same time.

Note:

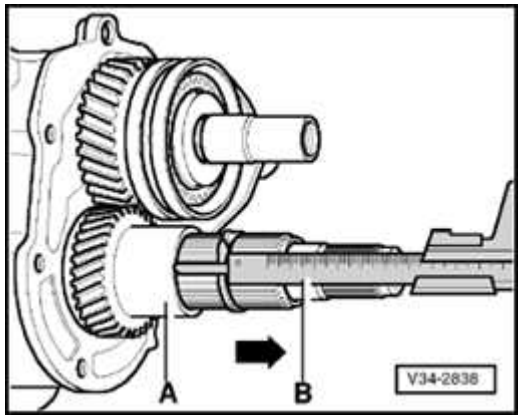
- *Selector fork rib (arrow -2-) must face towards shaft end.*
- *When sliding follower onto selector rod for 5th and 6th gear remember holes for roll pin.*



- Press in roll pin -A- flush.

Note:

Do not drive in roll pin, otherwise selector rod mounting will be damaged.



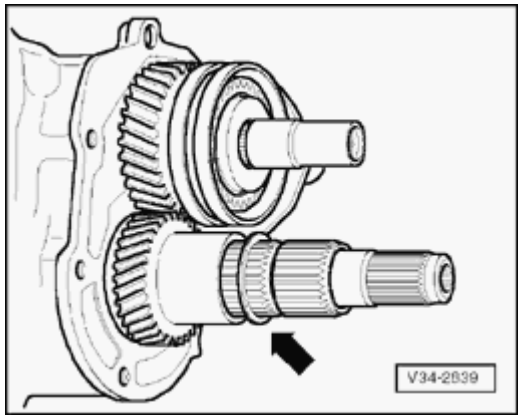
Re-determining shim for 5th speed gear:

- Fit spacer sleeve -A- (length 39.6 mm) onto hollow shaft.
- When fitting circlip, push in direction of arrow onto stop.
- Measure distance between sleeve and fitted circlip with depth gauge -B-.
- Determine shim from table.

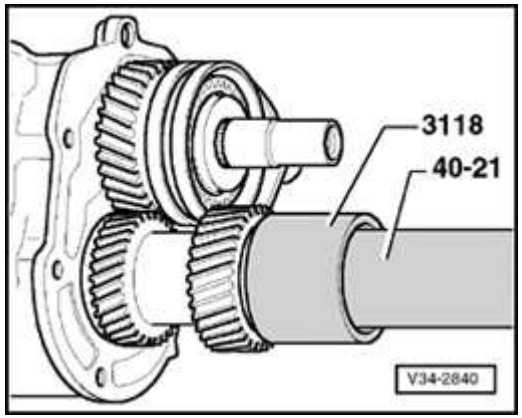
⇒ *Parts catalog*

The following shims are available:

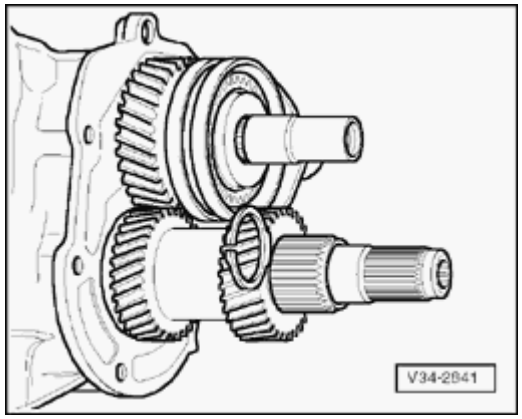
Measured range (mm)	Shim thickness (mm)
31.01-31.11	1.05
31.11-31.21	1.15
31.21-31.31	1.25
31.31-31.41	1.35



- Fit shim selected (arrow) onto hollow shaft.



- Heat 5th speed gear to approx. 120 ° C, fit and drive onto stop free of play.
  - ♦ Installation position: shoulder toward spacer sleeve



➢ Re-determining circlip for 5th speed gear:

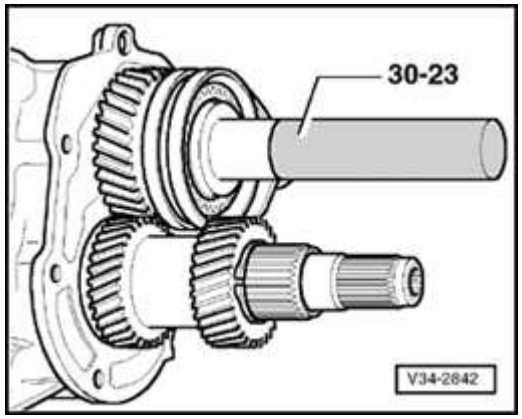
- Determine thickest circlip that can still just be fitted.
- Determine circlip from table.

⇒ *Parts catalog*

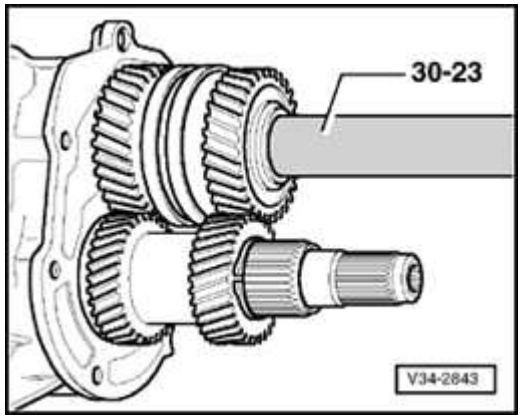
The following circlips are available:

Circlip thickness (mm)		
2.32	2.40	2.48
2.34	2.42	2.50
2.36	2.44	
2.38	2.46	

- Fit circlip.

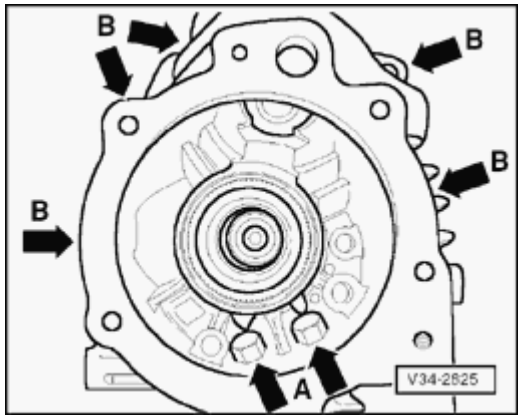


- Drive on inner race for 5th speed sliding gear free of axial play.
- Oil needle bearing with gear oil and fit.
- Place synchro-ring for 5th gear in locking collar.
- Slide on 5th speed sliding gear with spring.



- Heat 1st inner race for ball bearing for input shaft to approx. 100 ° C, fit onto input shaft and drive onto stop; ensure there is no play.
- Check 5th speed sliding gear for axial clearance.

  Permissible axial clearance: 0.15-0.35 mm
- Insert dowel sleeves into bearing plate.
- Fit new gasket for end cover.

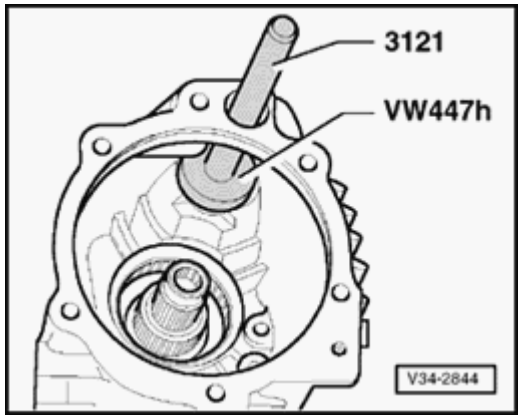


- Fit end cover and insert securing bolts (arrows -B-).

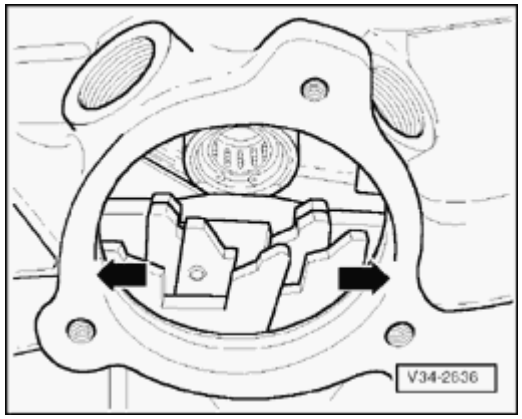
Note:

Do not tighten bolts.

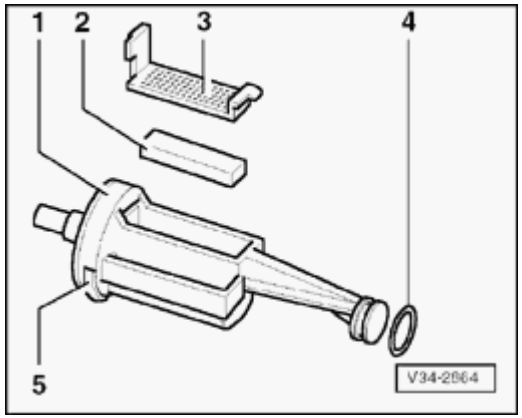
- Clean two magnets (arrows -A-) and insert.
- Fit support plate and tighten hand tight.
  - Installation position: Lugs towards magnets
- Tighten bolts for end cover using diagonal sequence.



- Oil 2nd inner race and with ball contact surface facing towards input shaft ball bearing, drive onto input shaft through hole in end cover.
- Remove support bridge 30-211 A.



- Lock input shaft by engaging 2 gears (e.g. reverse and 2nd gear), do this by moving two selector plates (arrows).
- Tighten multi-point socket head bolt to 150 Nm.

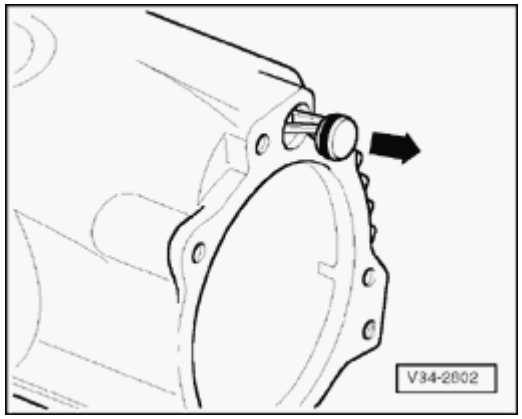


- Unclip cover -3- for oil collector from oil collector -1- at longer end with a screwdriver and remove magnet -2-.

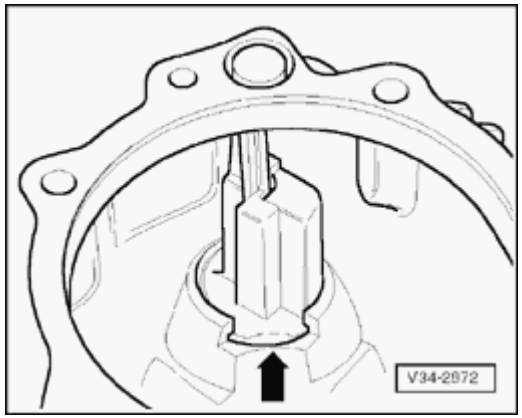
4 - O-ring

5 - Positioning segment

- Clean oil collector.
- Assemble oil collector.



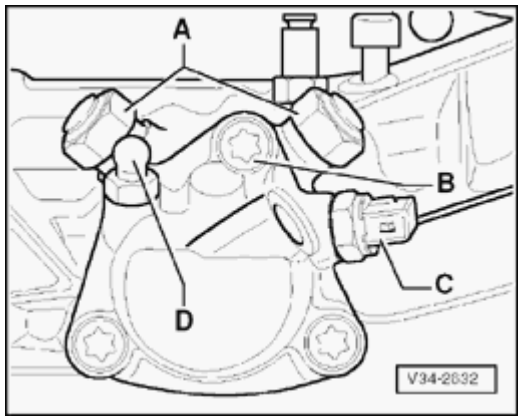
- Guide oil collector from interior of end cover with support arm leading through hole of end cover (arrow), until O-ring can be fitted from outside onto oil collector.
- Lightly oil new O-ring and fit.
- Insert oil tube of oil collector into input shaft.



- Turn oil collector until the positioning segment is located in the machined recess of the end cover (arrow).
- Press in oil collector onto stop.
- Slide assembly sleeve, Part No. 01E 311 120, onto selector shaft.
- Check neutral position of followers.

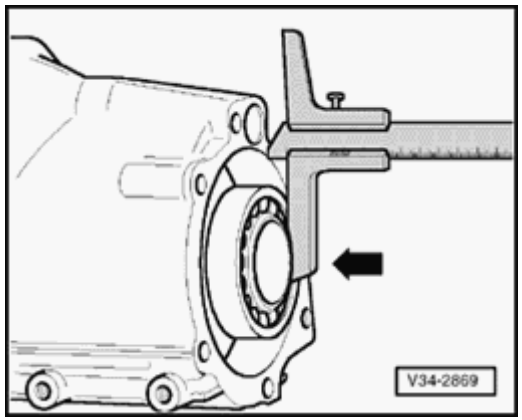
  Selector gates must align.

- Install complete selector shaft.



- Screw locking bolts -A- for selector shaft into transmission housing.
- Aluminium and steel bolts must not be interchanged when installing.

  Tightening torques: for aluminium locking bolts = 50 Nm, and for steel locking bolts = 70 Nm.
- Lightly oil new O-ring for cover for selector shaft and fit.
- Fit cover for selector shaft.
- Apply sealing paste AMV 188 000 02 to bolts -B- (Qty. 3) before installing and tighten.
- Slide Torsen differential onto splines of hollow shaft.



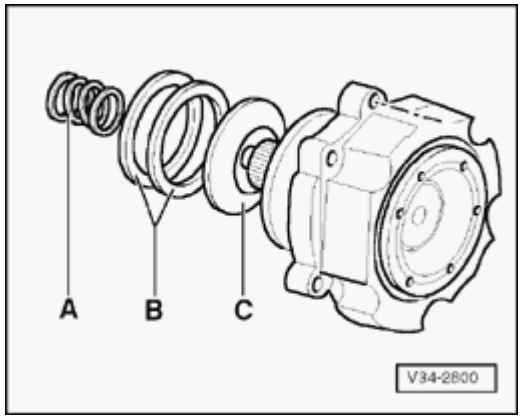
- Press Torsen differential in direction of arrow, and measure distance between top edge of bolted end cover and front edge of outer race of ball bearing for Torsen differential.
- Determine required shim(s) from following table.

⇒ *Parts catalog*

The following shims are available:

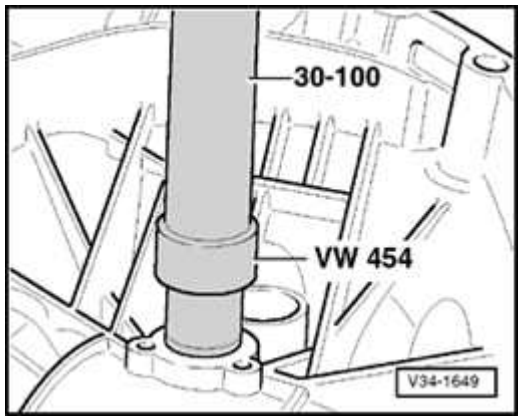
Measured range mm	Qty.	Shim thickness (mm)
7.05-7.30	1	1.65
	1	1.45
	1	1.20
7.30-7.55	1	1.65
	1	1.45
	1	0.95
7.55-7.80	1	1.65
	1	1.45
	1	0.70
7.80-8.05	1	1.65
	1	1.45
	1	0.45
8.05-8.25	2	1.65
8.25-8.50	1	1.65
	1	1.45

8.50-8.75	1 1	1.65 1.20
8.75-9.00	1 1	1.65 0.95
9.00-9.25	1 1	1.65 0.70
9.25-9.50	1 1	1.65 0.45



- Insert spring plate -C- into bearing housing.

  Installation position: larger diameter (concave side) towards the shims.
- Fit shims -B- as determined in table.
- Fit spring -A- to end of drive flange.
- Lightly oil new O-ring for bearing housing and fit.
- Oil small needle bearing in drive pinion.
- Insert complete bearing housing and pull home evenly.
- Tighten bearing housing using diagonal sequence.
- Fill new seal for drive axle between sealing lip and dust lip with sealing grease G52 128 A1.
- Pull a thin protective hose tightly onto splines of input shaft.



- Drive on seal for input shaft.
  - Pressing-in depth (factory): 3.5 mm
  - Pressing in depth (repairs): 4.5 mm

- Remove protective hose.

- Install release bearing, clutch release lever and guide sleeve ⇒ from Page 30-27 .

- Check that transmission can be shifted through all gears.

- Fit connecting rod.

- Check oil level in transmission ⇒ Page 34-39 .

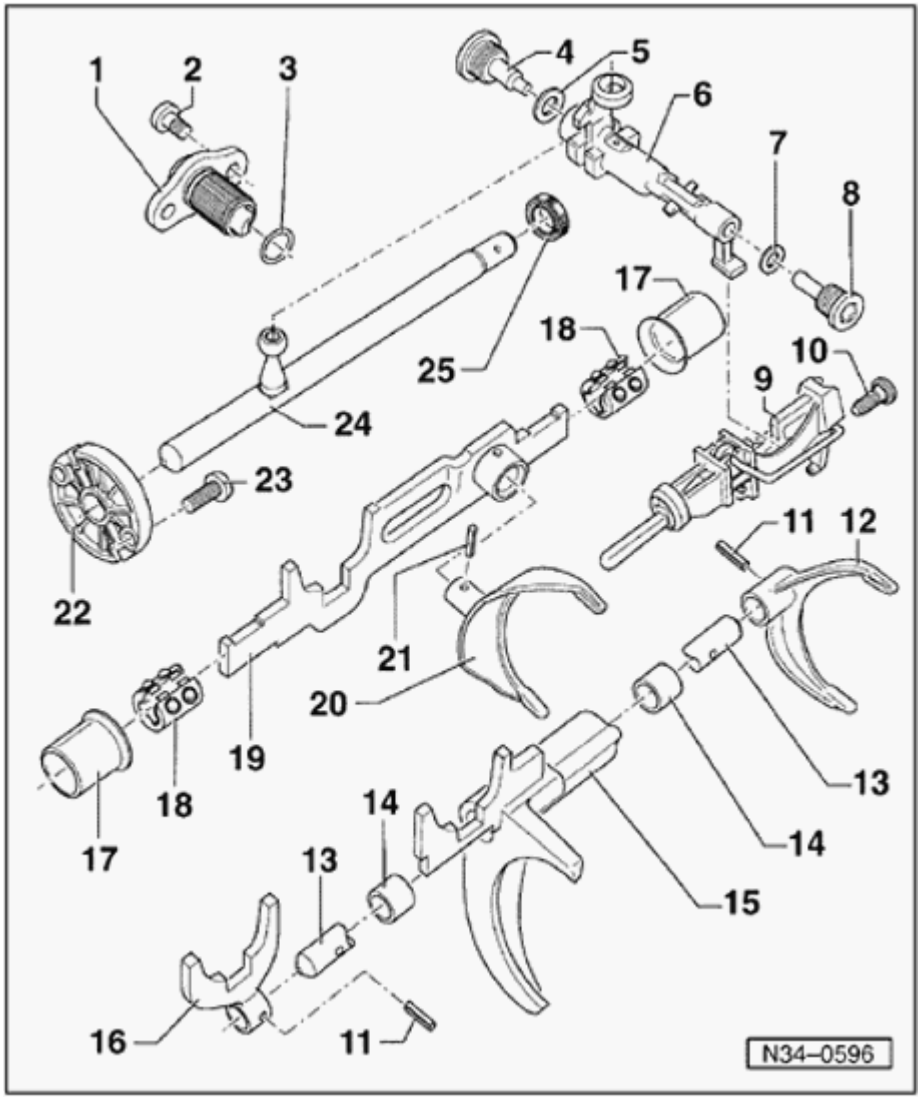
34-62

Transmission selector mechanism, disassembling and assembling

Special tools and equipment

- VW295 needle bearing drift
- VW295A needle bearing drift
- VW401 thrust plate
- VW423 sleeve
- VW472/2 spacer sleeve
- VW771 peening tool
- Kukko 21/4 extractor

34-63



Note:

For the installation position of the complete selector mechanism in transmission ⇒ Fig. 6 .

1 - Gear lock 5th and reverse gear

- Removing and installing ⇒ Page 34-69

2 - Torx® bolt

- 10 Nm (7 ft lb)

3 - O-ring

- Always replace

4 - Right stop bolt

- 40 Nm (30 ft lb)

5 - Sealing washer

6 - 7Relay shaft

8 - Sealing washer

9 - Left stop bolt

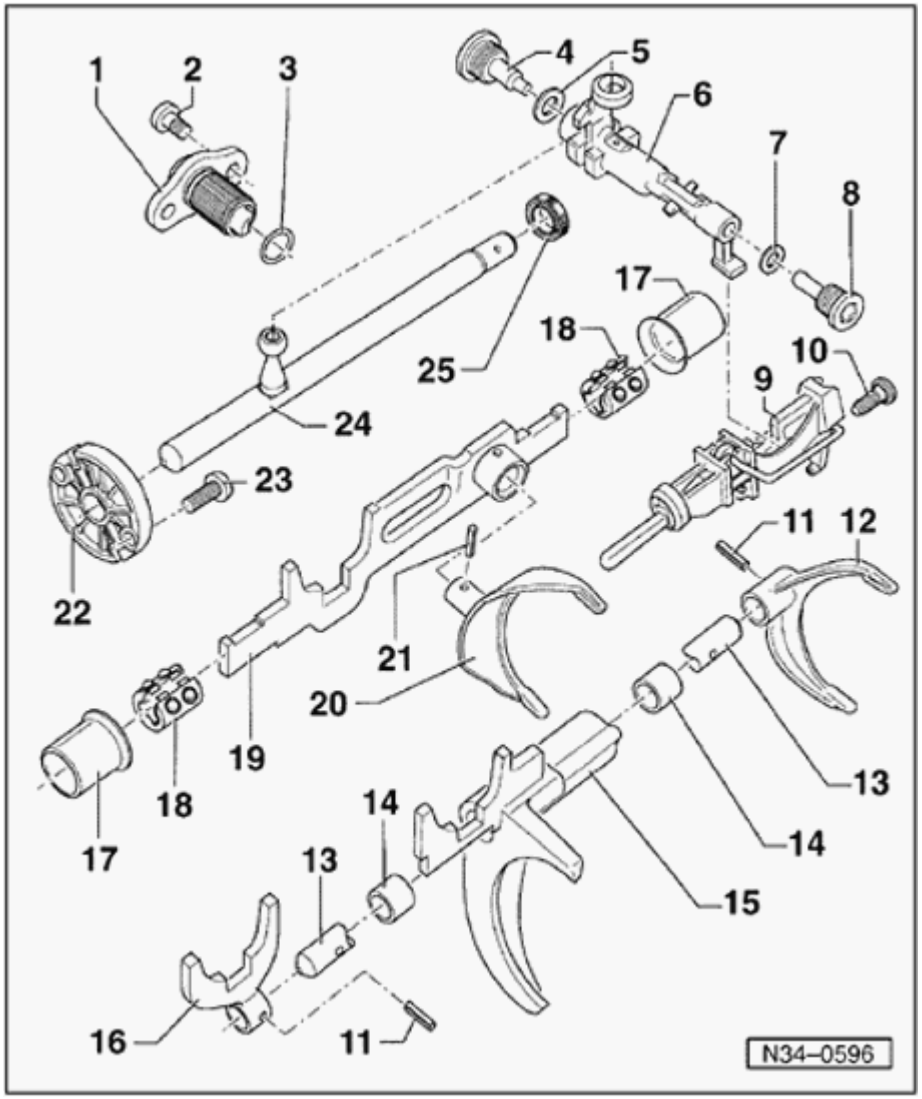
- 40 Nm (30 ft lb)

10 - Shift detent

11 - Torx® bolt

- 25 Nm (18 ft lb)

34-64



12 - Roll pin

13 - 5th and reverse gear shift fork

- Installation position ⇒ Fig. 1

14 - Shift rod for 1st and 2nd gear and for 5th and reverse gear

15 - Ball sleeve

- Removing and installing ⇒ Fig. 2

16 - Shift fork for 1st and 2nd gear

17 - Coupling plate

- Installation position ⇒ Fig. 1

18 - 19Bushing for 3rd and 4th gear

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

20 - Ball sleeve

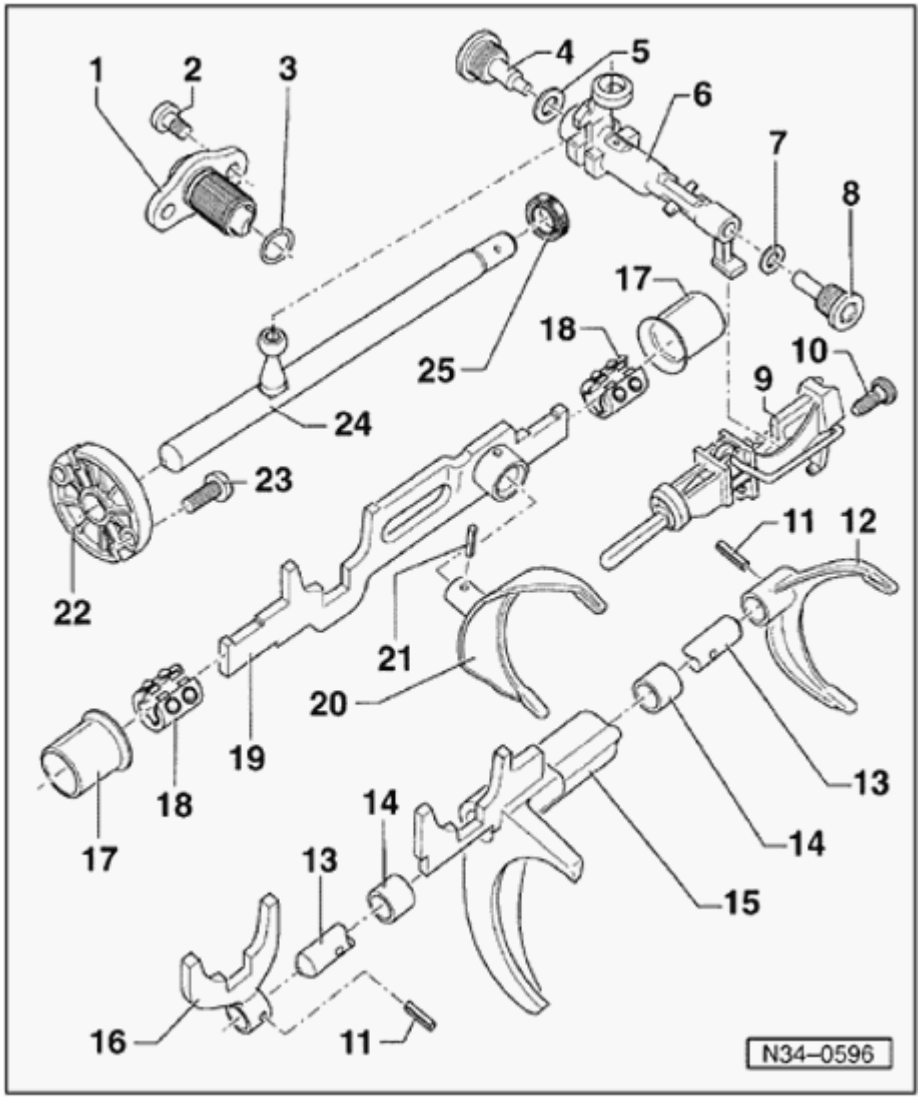
- Pry off selector rod using screwdriver
- Press onto selector rod

21 - Shift rod for 3rd and 4th gear

22 - Shift fork for 3rd and 4th gear

23 - Roll pin

34-65



24 - Cover

- For shift rod

25 - Torx® bolt

- 20 Nm (15 ft lb)

26 - Shift rod

27 - Sealing washer

- Pry out using screwdriver
- Installation position ⇒ Fig. 5

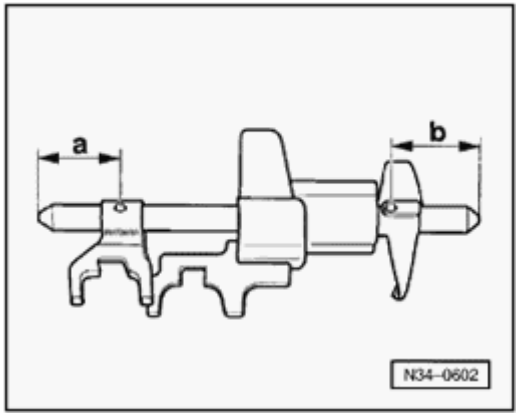


Fig. 1 Installation position of 5th and reverse gear shift fork and coupling plate for shift rod

- Dimension -a-: 55 mm (2.165 in.)
- Dimension -b-: 60 mm (2.362 in.)

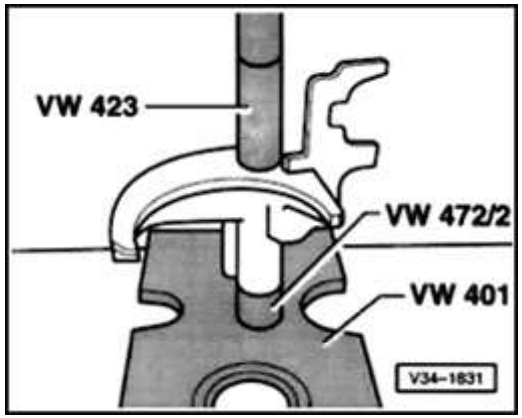


Fig. 2 Removing and installing ball sleeve

34-67

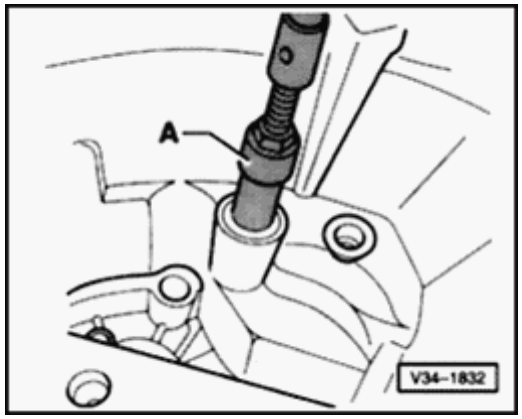


Fig. 3 Removing bushing for 3rd and 4th gear shift rod

A - Internal puller 22-28 mm, e.g. Kukko 21/4 extractor, in conjunction with VW771 slide hammer-complete set.

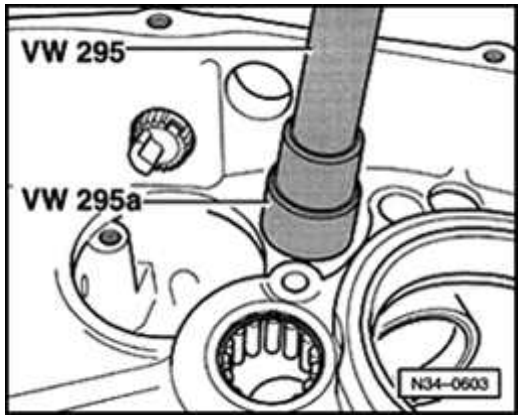


Fig. 4 Driving in bushing for 3rd and 4th gear shift rod onto stop

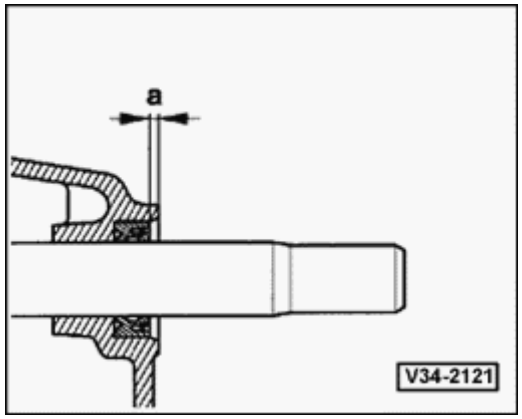


Fig. 5 Installation position of sealing washer

- Lubricate sealing lip and dust lip with gear oil.
- Lightly oil outer circumference of seal.

Dimension -a- : 1 mm (0.04 in.)

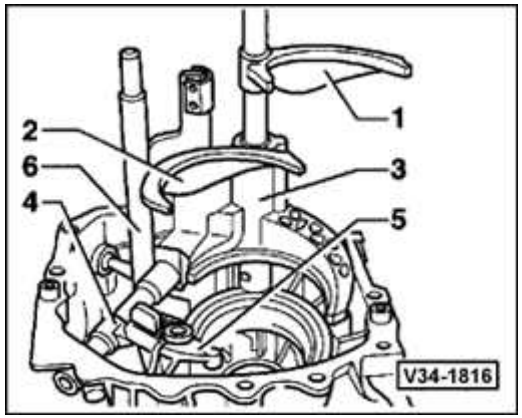


Fig. 6 Installation position of complete selector mechanism in transmission

1 - Shift fork for 5th and reverse gear

2 - Shift fork for 3rd and 4th gear

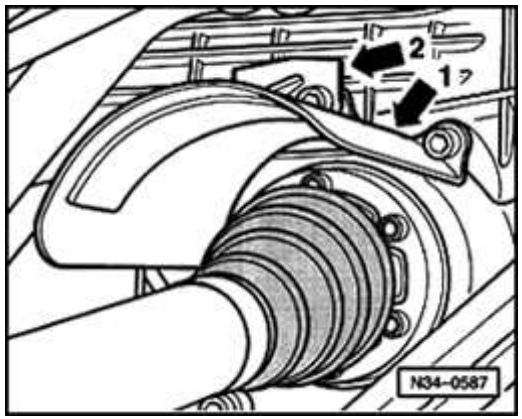
3 - Shift fork for 1st and 2nd gear

4 - Relay shaft

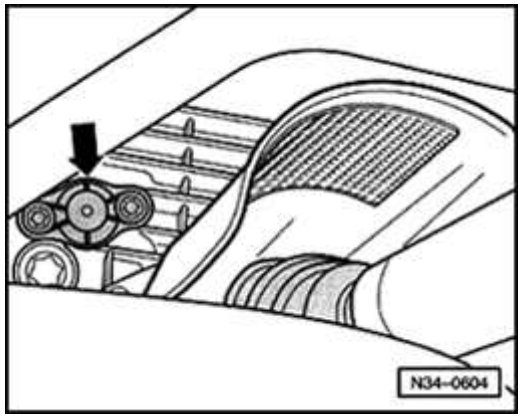
5 - Shift detent

6 - Shift rod

Removing and installing gear lock for 5th and reverse gear



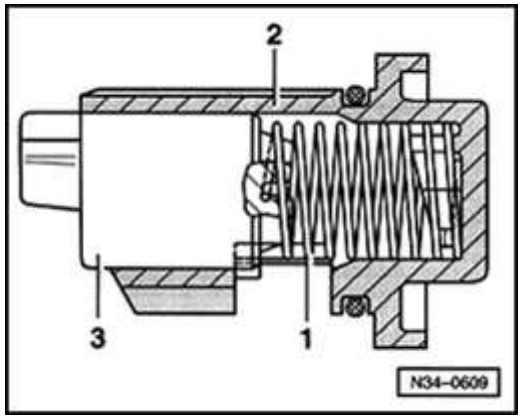
- Remove heat shield (arrow -2-) above right drive axle.
- Detach heat shield (arrow -1-) above right drive axle and pivot downward.



- Remove gear lock (arrow).

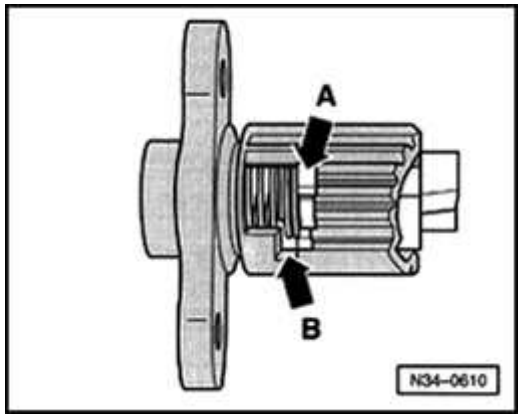
34-70

Assembling gear lock



- Insert spring -1- into housing -2- and, while applying light pressure, turn spring to left until it locates in base of housing.
- Insert bushing -3- onto spring so bent end of spring locates into groove properly.
- Push bushing against spring and turn approximately one turn to left, until lug on bushing aligns with groove in housing.
- Press lug of bushing into groove in housing onto stop.
- Turn bushing to right and release.

  The bushing will spring into the correct position.



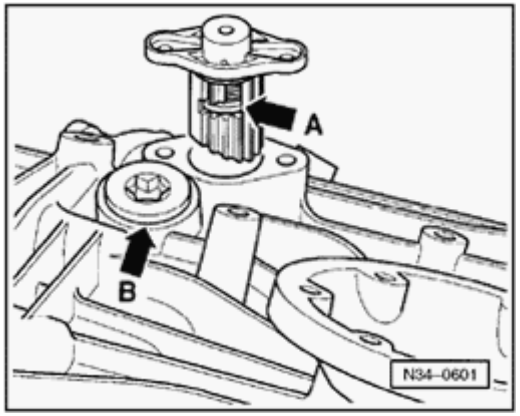
Installation position of bushing:

- Lug (arrow -A-) of bushing must always face away from groove in housing (arrow -B-).

Checking installation position:

- Turn bushing to left and release.

  The bushing should spring back into position; the lug must be against the stop (direction indicated by arrow -A-).



➢ Installation position of complete gear lock in transmission:

The recess (arrow -A-) faces bolt (arrow -B-).

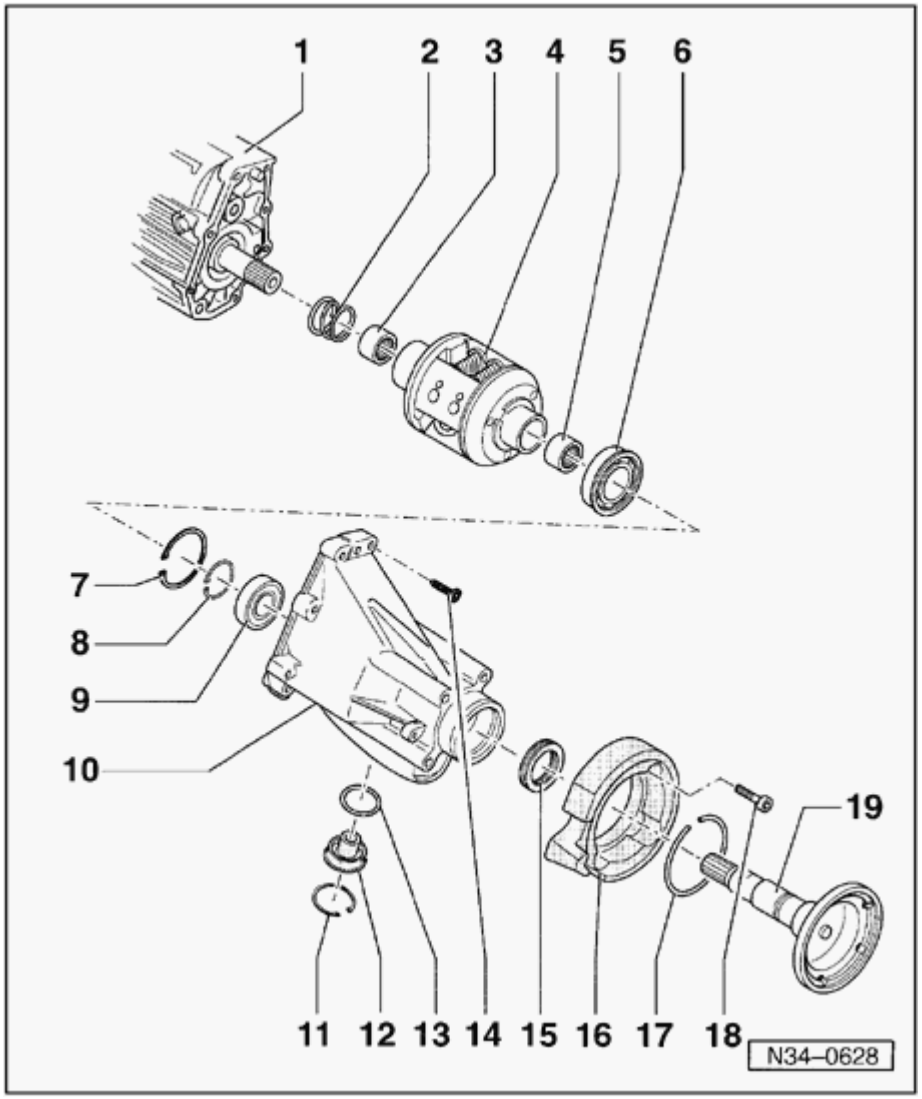
Torsen differential, disassembling and assembling

Special tools and equipment

- VW401 and VW402 thrust plate
- VW407 punch
- VW412 punch
- VW416B tube
- VW421 tube
- VW439 guide pin
- VW519 sleeve
- VW681 extractor lever
- VW771/15 threaded piece from VW771 slide hammer-complete set
- 40-21 sleeve

- 2040 press tube
- 3002 pressure piece
- Kukko 17/2 separating tool
- Kukko 21/4 extractor

34-69



1 - Transmission housing

2 - Spring

3 - Front needle bearing

- Pulling out ⇒ Fig. 8
- Installation position ⇒ Fig. 9
- Pressing in ⇒ Fig. 11

4 - Torsen differential

- Do not disassemble
- Press out after removing flange shaft ⇒ Fig. 3
- Replace if damaged
- Pressing in ⇒ Fig. 12

5 - Rear needle bearing

- Pulling out ⇒ Fig. 8
- Installation position ⇒ Fig. 10
- Pressing in ⇒ Fig. 11

6 - Ball bearing

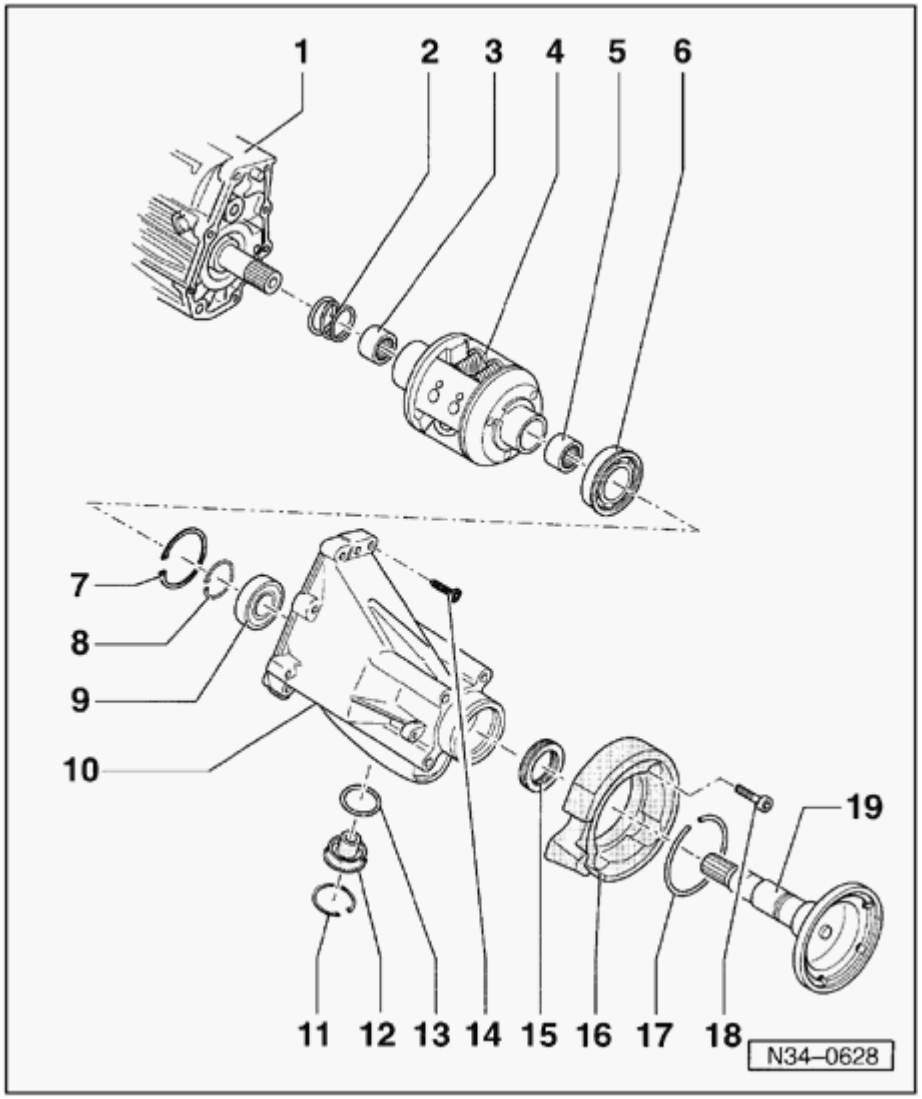
- For Torsen differential
- Pressing off ⇒ Fig. 4
- Pressing on ⇒ Fig. 5

7 - Circlip

8 - Circlip

- Remove and install together with flange shaft ⇒ Fig. 2

34-70



9 - Ball bearing

- For flange shaft
- Pressing out ⇒ Fig. 6
- Pressing in ⇒ Fig. 7

10 - Torsen differential cover

11 - Circlip

12 - Plug

- Removing ⇒ Fig. 1

13 - O-ring

- Always replace
- Lubricate before installing

14 - Torx® bolt

- 22 Nm (16 ft lb)

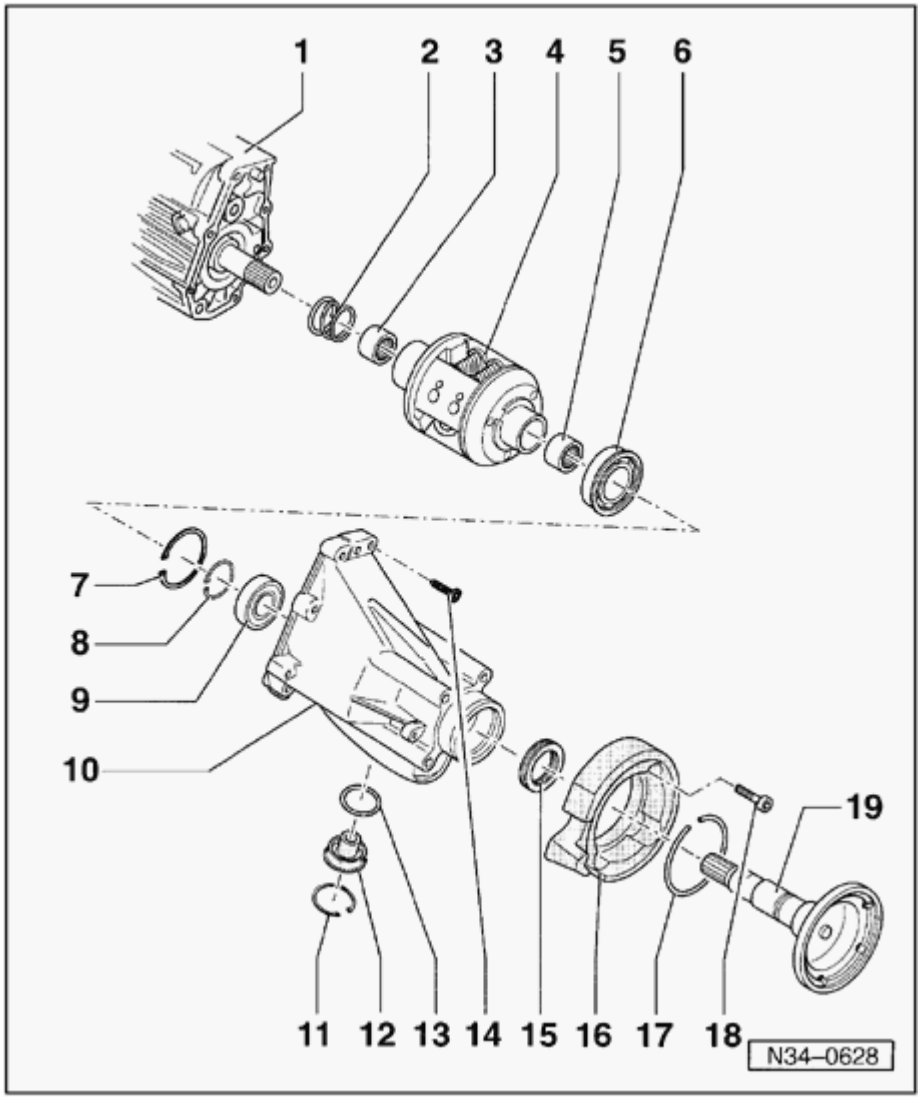
15 - Seal

- Pull out using VW681 extractor lever
- Driving in ⇒ Fig. 13

16 - Vibration dampener

17 - Circlip

34-71



18 - Torx® bolt

- Always replace
- 35 Nm (26 ft lb)
- Self-locking

19 - Flange shaft

- Removing and installing ⇒ Fig. 2

34-72

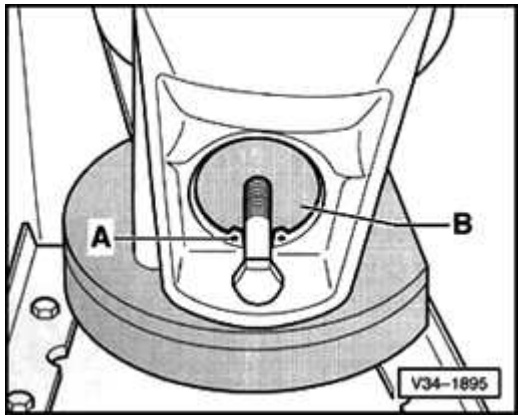


Fig. 1 Removing plug

- Remove circlip -A-.
- Screw M8 bolt into thread of plug -B-.
- Remove plug -B- using bolt.

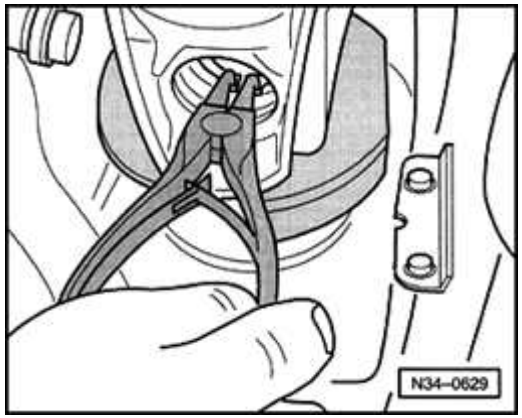


Fig. 2 Removing and installing flange shaft

- Spread circlip and pull out flange shaft.
- When installing flange shaft, circlip must be installed at same time.

  The circlip must be fully seated in the base of the groove.

34-73

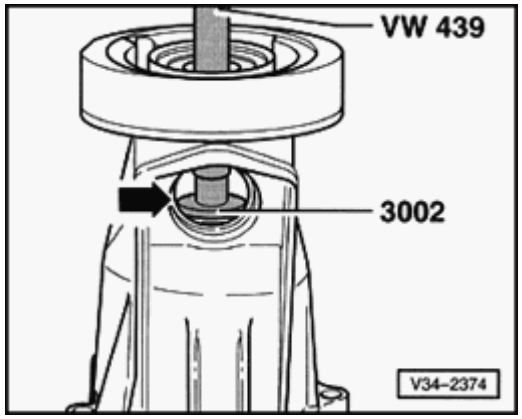


Fig. 3 Removing Torsen differential

- Position 3002 thrust piece directly on Torsen differential through opening (arrow).

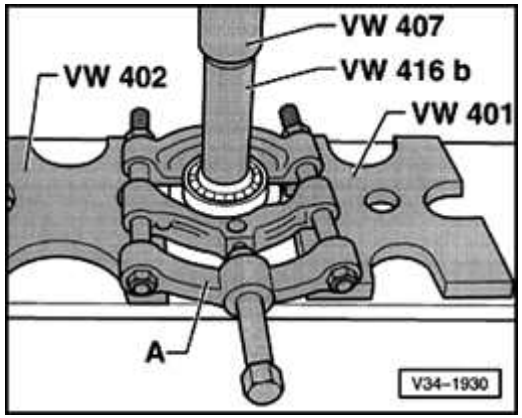


Fig. 4 Pressing off ball bearing from Torsen differential

A - Separating tool 22-115 mm, e.g. Kukko 17/2

34-74

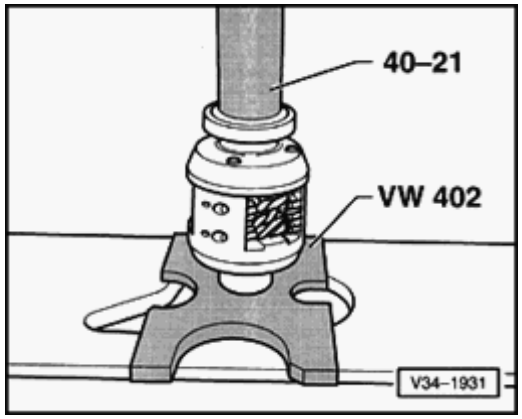


Fig. 5 Pressing ball bearing onto Torsen differential

- Press ball bearing on until stop is reached.

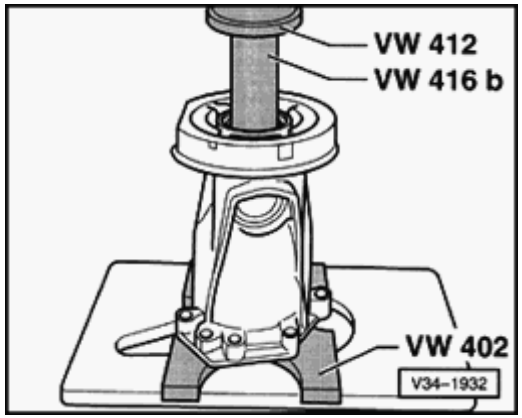


Fig. 6 Pressing out ball bearing for flange shaft

- Remove circlip before pressing out bearing.

34-75

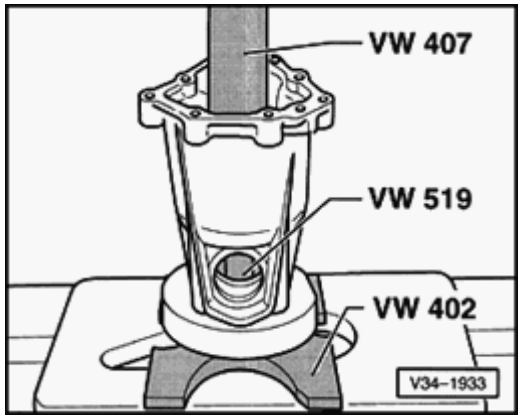


Fig. 7 Pressing in ball bearing for flange shaft

- Install circlip after pressing in ball bearing.

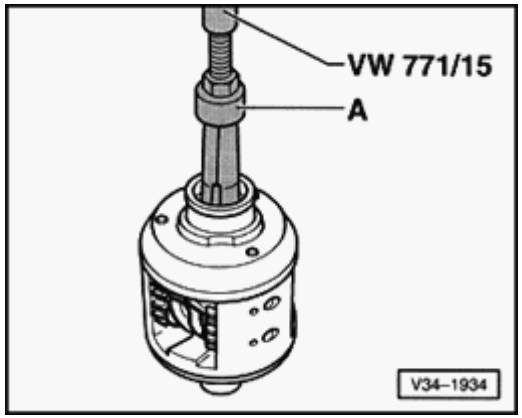


Fig. 8 Pulling out needle bearing

A - Extractor 22-28 mm, e.g. Kukko 21/4

Both needle bearings in the Torsen differential are removed using the same puller.

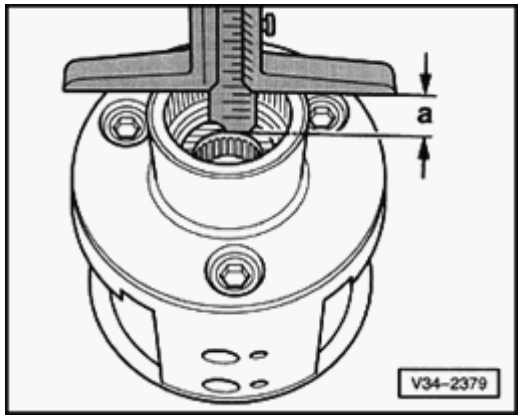


Fig. 9 Installation position of front needle bearing

Dimension -a-: 32.5 mm (1.279 in.)

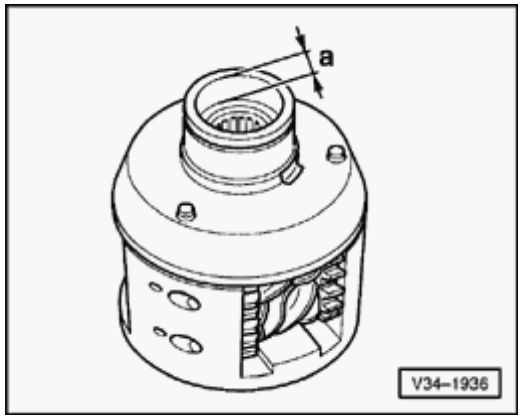


Fig. 10 Installation position of rear needle bearing

Dimension -a-: 14 mm (0.551 in.)

34-77

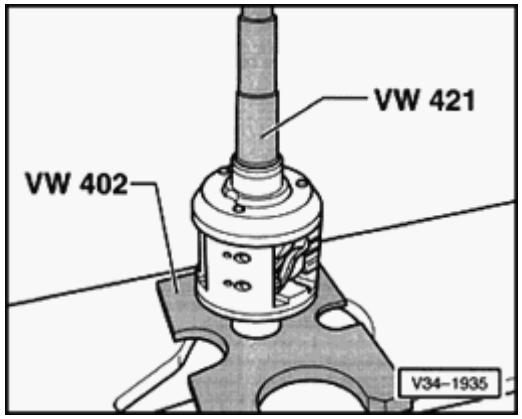


Fig. 11 Pressing in needle bearing

Both needle bearings in the Torsen differential are pressed in using the same special tool.

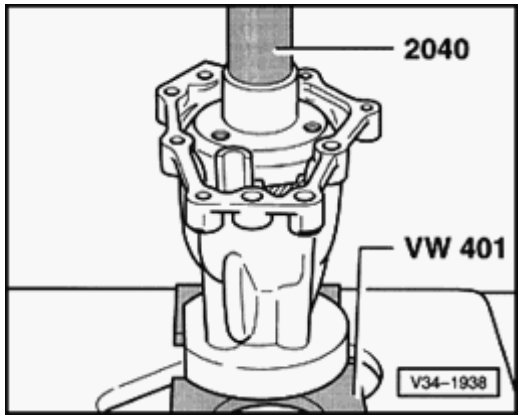


Fig. 12 Pressing in Torsen differential

34-78

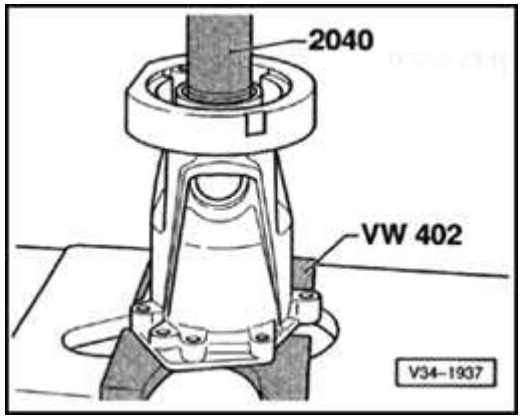


Fig. 13 Driving in seal

- Lubricate sealing lip and dust lip with gear oil.
- Lightly oil outer circumference of seal.

  Installation position: 2 mm (0.078 in.) below surface of cover

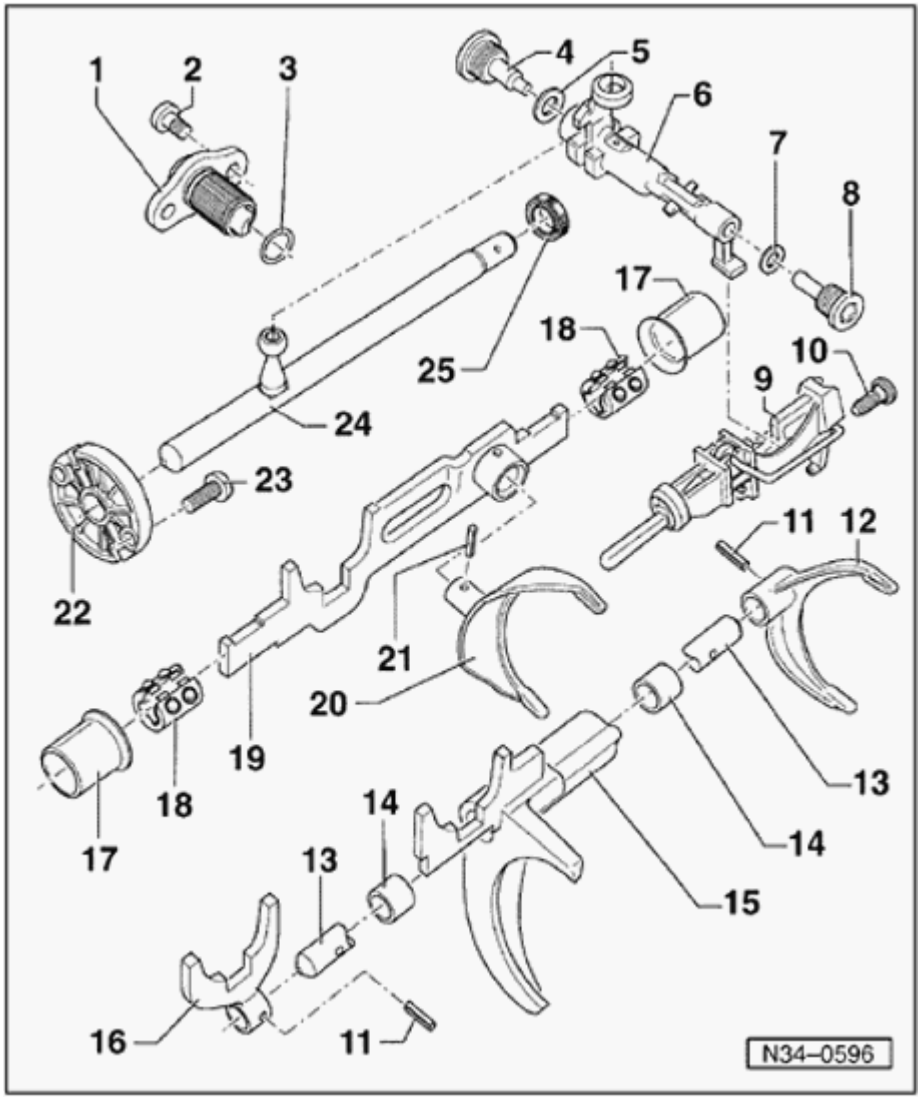
34-79

Transmission selector mechanism, disassembling and assembling

Special tools and equipment

- VW295 needle bearing drift
- VW295A needle bearing drift
- VW401 thrust plate
- VW423 sleeve
- VW472/2 spacer sleeve
- VW771 peening tool
- Kukko 21/4 extractor

34-80



Note:

For the installation position of the complete selector mechanism in transmission ⇒ Fig. 6 .

1 - Gear lock 5th and reverse gear

- Removing and installing ⇒ Page 34-86

2 - Torx® bolt

- 10 Nm (7 ft lb)

3 - O-ring

- Always replace

4 - Right stop bolt

- 40 Nm (30 ft lb)

5 - Sealing washer

6 - Relay shaft

7 - Sealing washer

8 - Left stop bolt

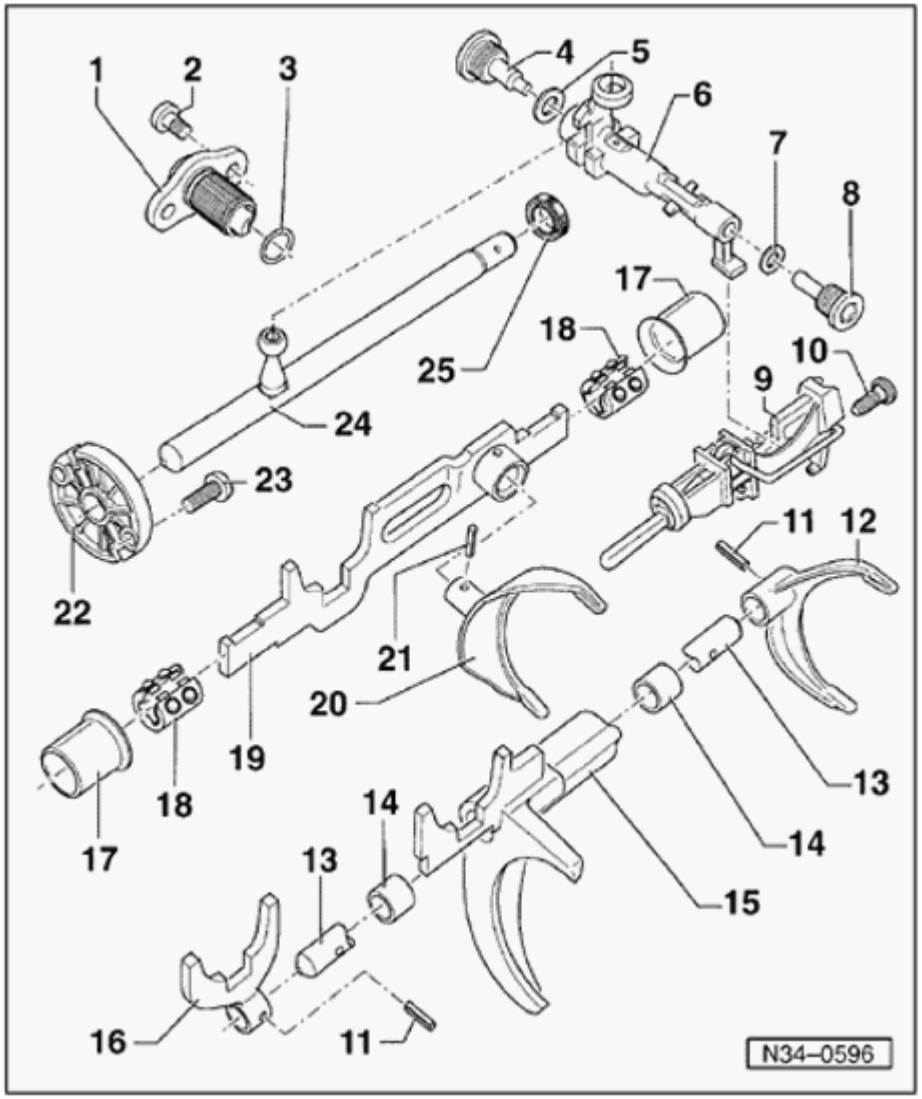
- 40 Nm (30 ft lb)

9 - Shift detent

10 - Torx® bolt

- 25 Nm (18 ft lb)

34-81



11 - Roll pin

12 - 5th and reverse gear shift fork

- Installation position ⇒ Fig. 1

13 - Shift rod for 1st and 2nd gear and for 5th and reverse gear

14 - Ball sleeve

- Removing and installing ⇒ Fig. 2

15 - Shift fork for 1st and 2nd gear

16 - Coupling plate

- Installation position ⇒ Fig. 1

17 - Bushing for 3rd and 4th gear

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

18 - Ball sleeve

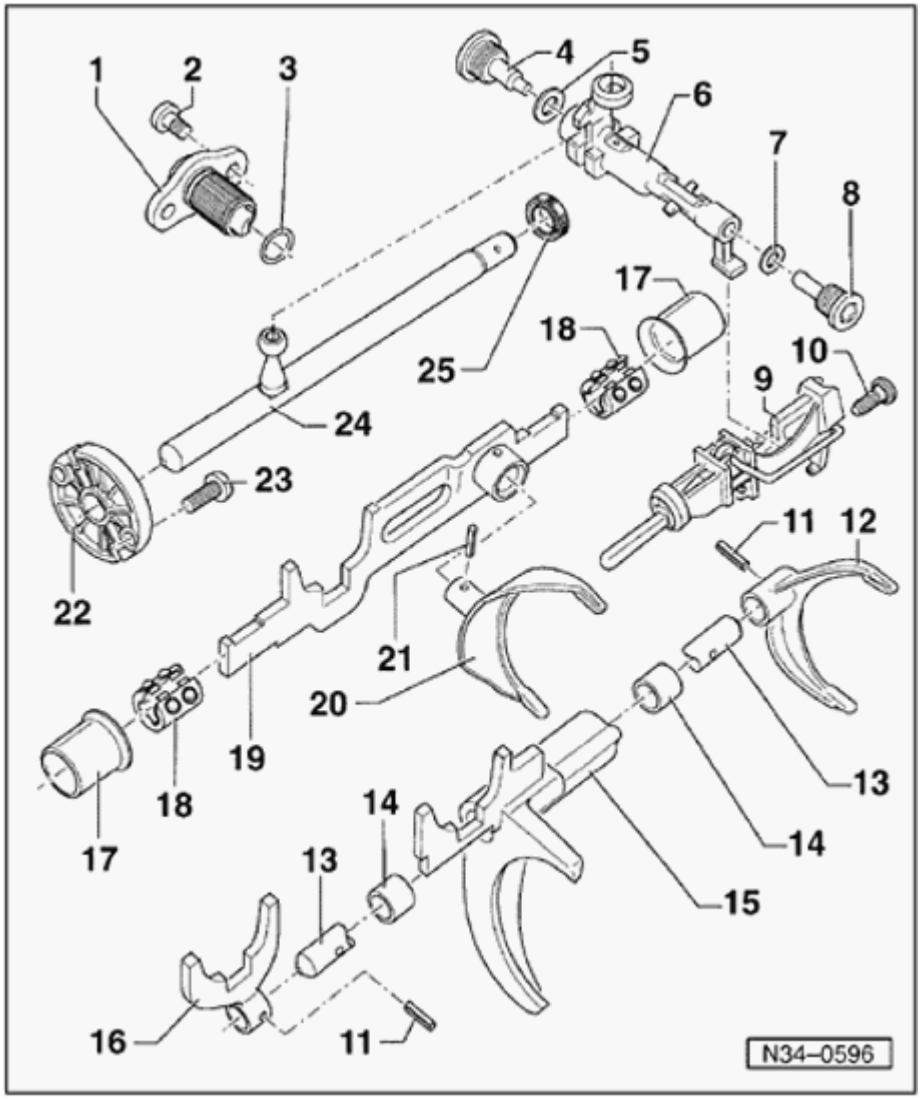
- Pry off selector rod using screwdriver
- Press onto selector rod

19 - Shift rod for 3rd and 4th gear

20 - Shift fork for 3rd and 4th gear

21 - Roll pin

34-82



22 - Cover

- For shift rod

23 - Torx® bolt

- 20 Nm (15 ft lb)

24 - Shift rod

25 - Sealing washer

- Pry out using screwdriver
- Installation position ⇒ Fig. 5

34-83

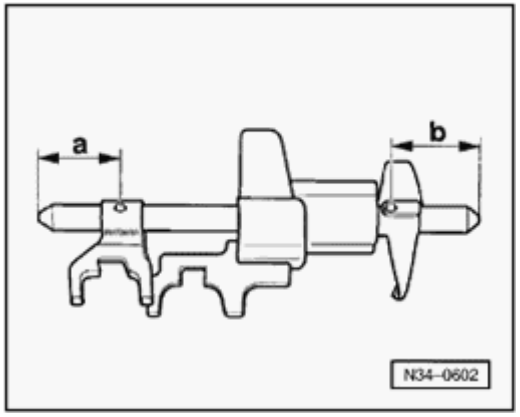


Fig. 1 Installation position of 5th and reverse gear shift fork and coupling plate for shift rod

- Dimension -a-: 55 mm (2.165 in.)
- Dimension -b-: 60 mm (2.362 in.)

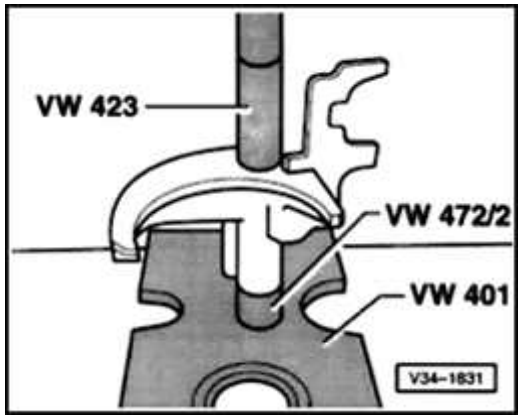


Fig. 2 Removing and installing ball sleeve

34-84

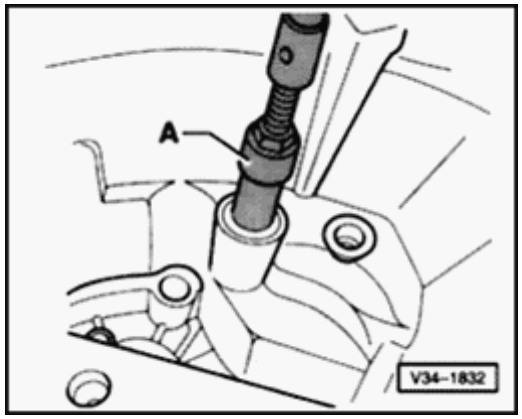


Fig. 3 Removing bushing for 3rd and 4th gear shift rod

A - Internal puller 22-28 mm, e.g. Kukko 21/4 extractor, in conjunction with VW771 slide hammer-complete set.

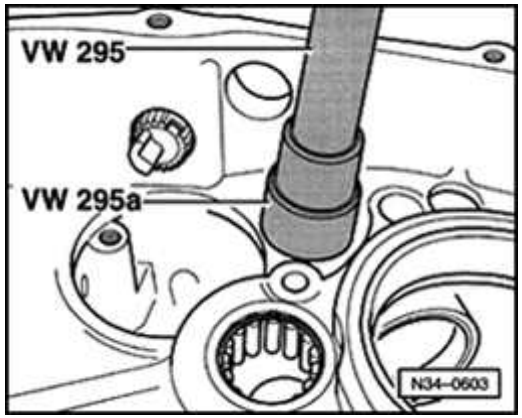


Fig. 4 Driving in bushing for 3rd and 4th gear shift rod onto stop

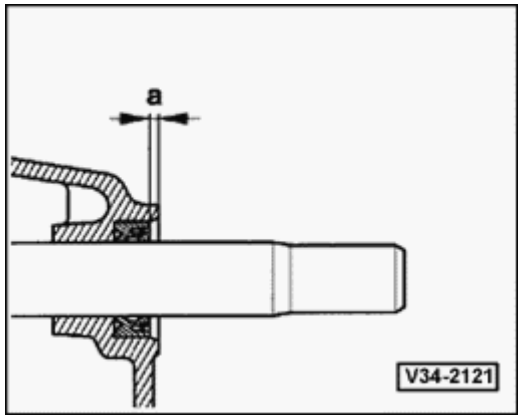


Fig. 5 Installation position of sealing washer

- Lubricate sealing lip and dust lip with gear oil.
- Lightly oil outer circumference of seal.

Dimension -a- : 1 mm (0.039 in.)

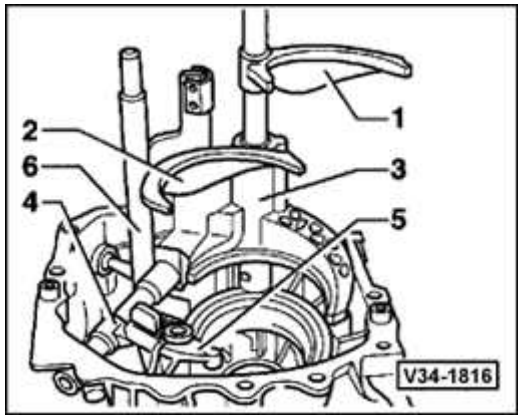


Fig. 6 Installation position of complete selector mechanism in transmission

1 - Shift fork for 5th and reverse gear

2 - Shift fork for 3rd and 4th gear

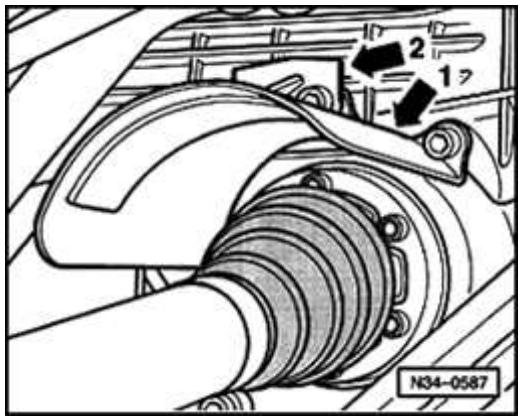
3 - Shift fork for 1st and 2nd gear

4 - Relay shaft

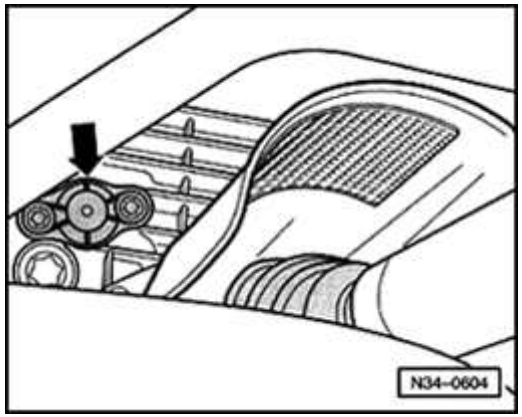
5 - Shift detent

6 - Shift rod

Removing and installing gear lock for 5th and reverse gear



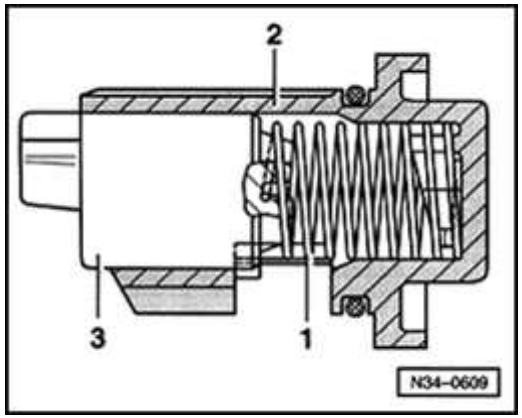
- Remove heat shield (arrow -2-) above right drive axle.
- Detach heat shield (arrow -1-) above right drive axle and pivot downward.



- Remove gear lock (arrow).

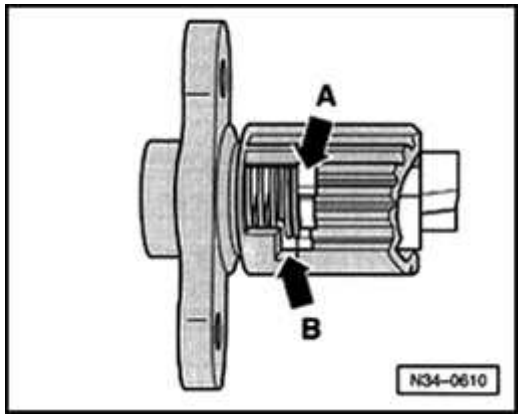
34-87

Assembling gear lock



- Insert spring -1- into housing -2- and, while applying light pressure, turn spring to left until it locates in base of housing.
- Insert bushing -3- onto spring so bent end of spring locates into groove properly.
- Push bushing against spring and turn approx. one turn to left, until lug on bushing aligns with groove in housing.
- Press lug of bushing into groove in housing onto stop.
- Turn bushing to right and release.

  The bushing will spring into the correct position



Installation position of bushing:

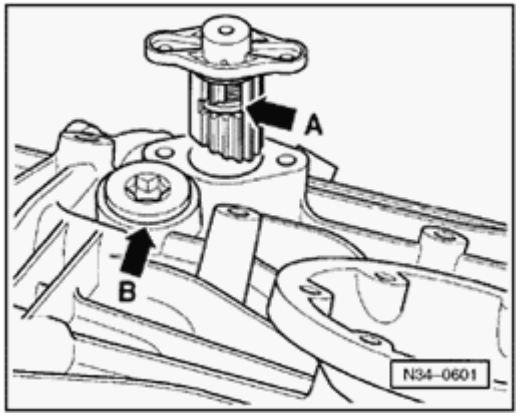
- Lug (arrow -A-) of bushing must always face away from groove in housing (arrow -B-).

Checking installation position:

- Turn bushing to left and release.

  The bushing should spring back into position; the lug must be against the stop (direction indicated by arrow -A-)

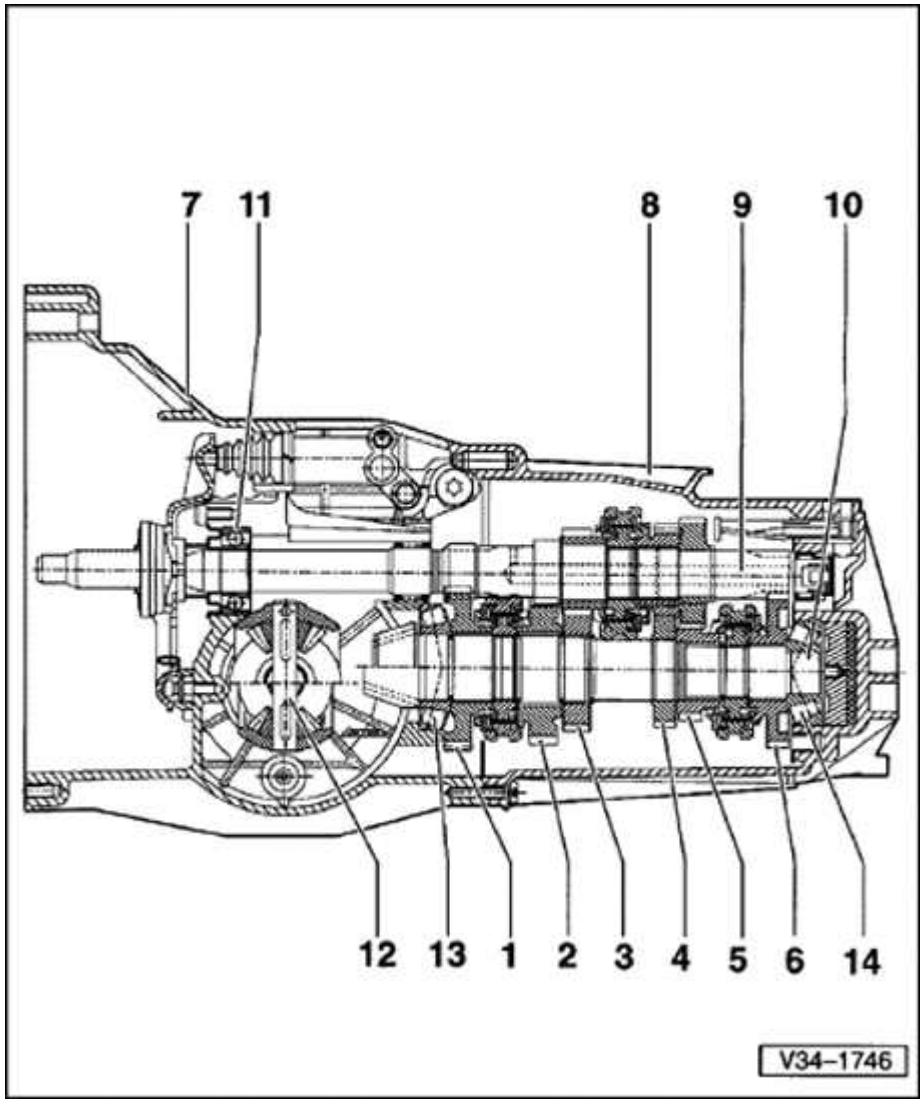
34-88



➢ Installation position of complete gear lock in transmission:

The recess (arrow -A-) faces bolt (arrow -B-)

34-38



Transmission, disassembling and assembling

Note:

Disassembly sequence ⇒ *Page 34-49* .

Transmission overview

1 - 1st gear

2 - 2nd gear

3 - 3rd gear

4 - 4th gear

5 - 5th gear

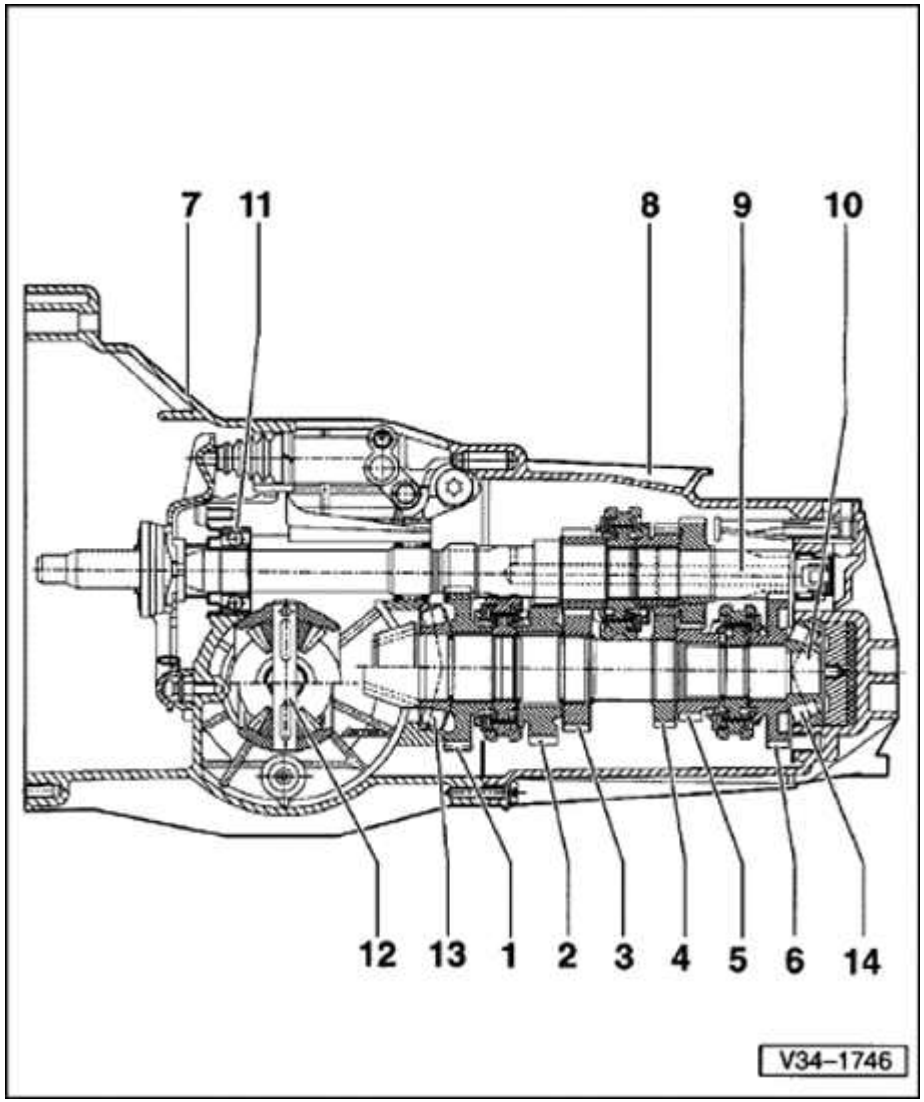
6 - Reverse gear

- Removing and installing reverse idler gear ⇒ Page 35-44

7 - Transmission housing

8 - Transmission cover

34-39



9 - Input shaft

- Disassembling and assembling ⇒ Page 35-1

10 - Pinion shaft

- Disassembling and assembling ⇒ Page 35-21

11 - Ball bearing

- Adjusting ⇒ Page 35-17 , Input shaft, adjusting

12 - Differential

- Removing and installing ⇒ Page 39-10
- Disassembling and assembling ⇒ Page 39-15

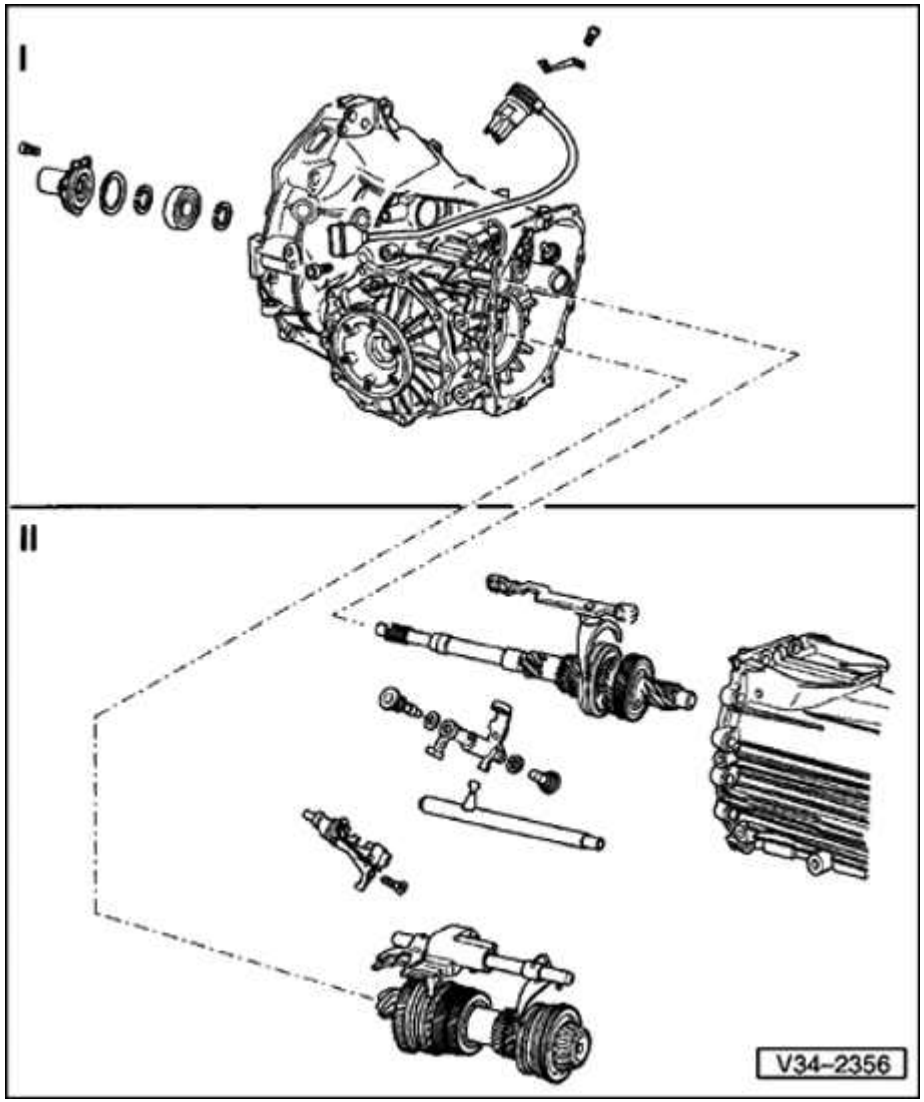
13 - Tapered roller bearing

- Adjusting ⇒ Page 39-35

14 - Tapered roller bearing

- Adjusting ⇒ Page 39-35

34-40

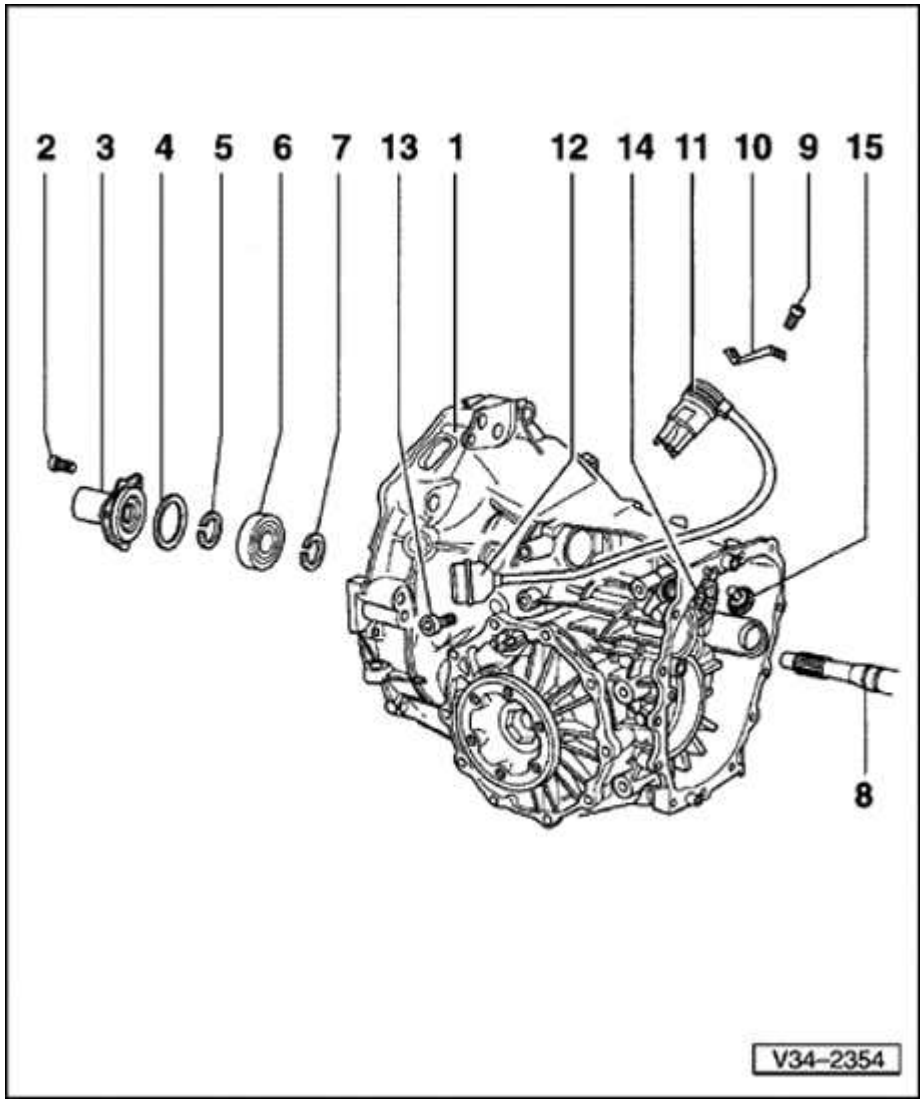


Assembly overview

I - Input shaft ball bearing and multi-function switch, removing and installing ⇒ Page 34-41

II - Input shaft, pinion shaft, selector rods and transmission cover, removing and installing ⇒ Page 34-45

34-41



Input shaft ball bearing and multi-function switch, removing and installing

1 - Transmission housing

- With differential and flange shafts
- Removing and installing flange shafts ⇒ Page 39-1
- Removing and installing differential ⇒ Page 39-10
- Removing and installing speedometer Vehicle Speed Sensor (VSS) ⇒ Page 39-7
- Removing and installing speedometer drive gear ⇒ Page 39-7
- Breather installation position ⇒Fig. 1

2 - Torx® bolt

- Always replace
- 35 Nm (26 ft lb)
- Self-locking

3 - Guide sleeve

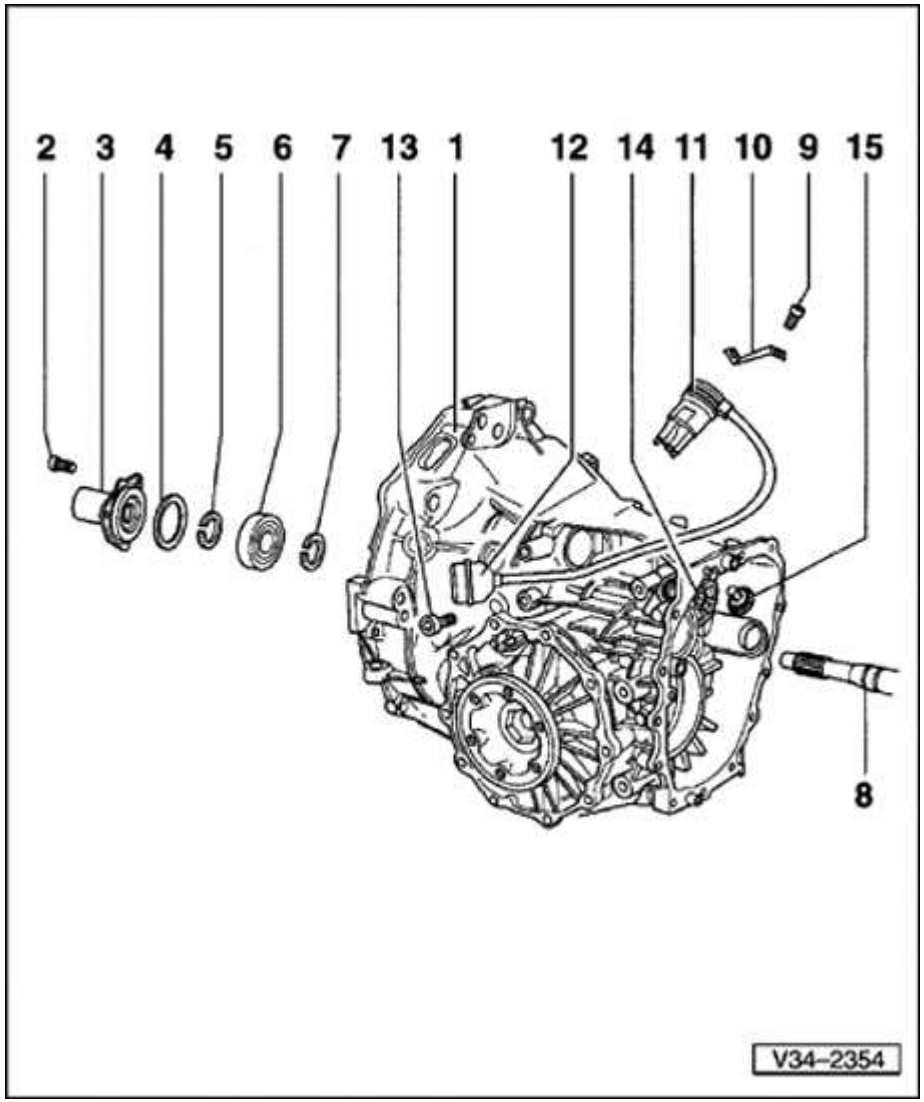
- Installed with O-ring and seal for input shaft ⇒ Page 30-17

4 - Dished washer

- Smaller diameter (convex side) faces guide

sleeve

34-42



5 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

6 - Input shaft ball bearing

- Removing and installing ⇒ Page 34-49

7 - Circlip

- Determining thickness and input shaft, adjusting ⇒ Page 35-17

8 - Input shaft

- Removing and installing ⇒ Page 34-45
- Disassembling and assembling ⇒ Page 35-1
- Adjusting ⇒ Page 35-17
- Servicing input shaft ball bearing ⇒ Page 35-1

9 - Socket-head bolt

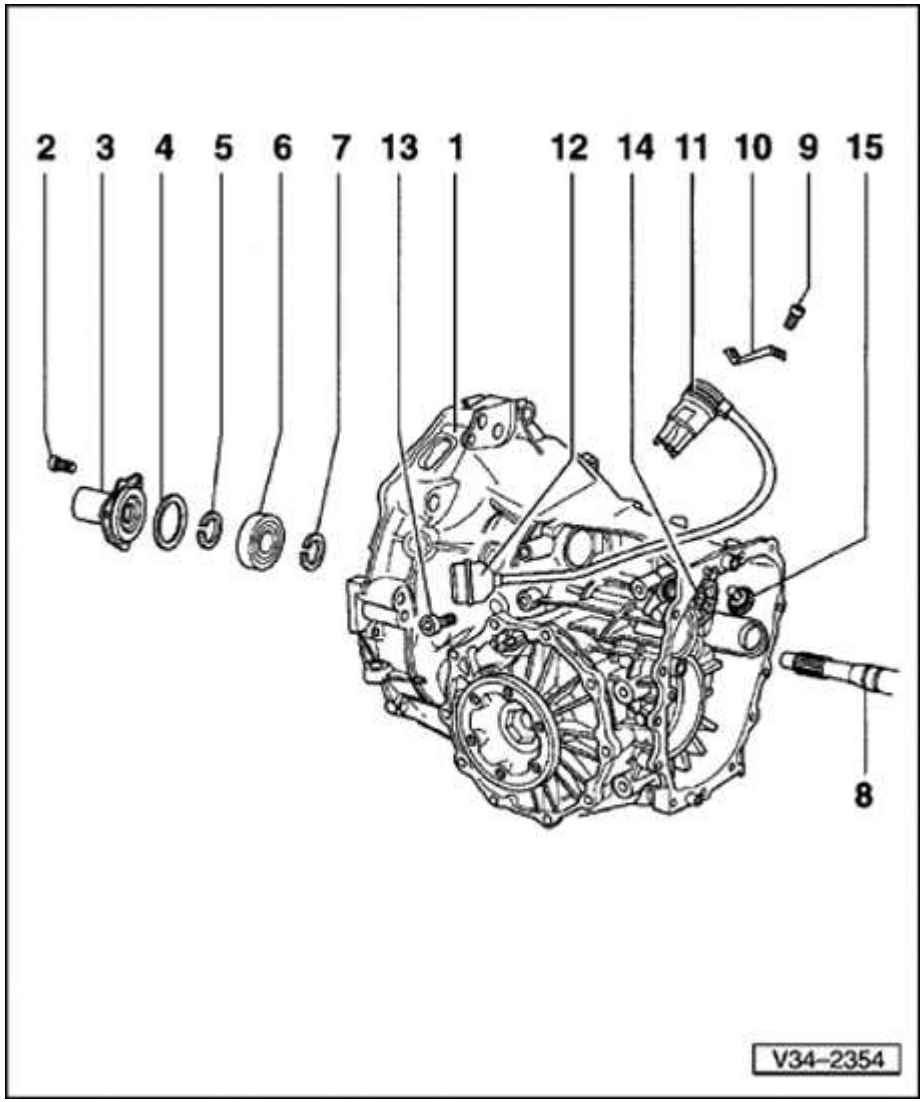
- 25 Nm (18 ft lb)

10 - Locking plate

- For multi-function switch

11 - Multi-function switch

34-43



12 - Multi-function switch harness connector

13 - Socket-head bolt

- 10 Nm (7 ft lb)

14 - Cover for shift rod

- Removing and installing ⇒ Page 34-62

15 - Gear lock for 5th and reverse gear

- Removing and installing ⇒ Page 34-69

34-44

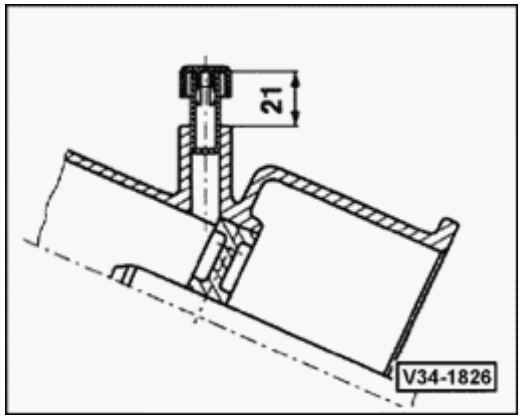
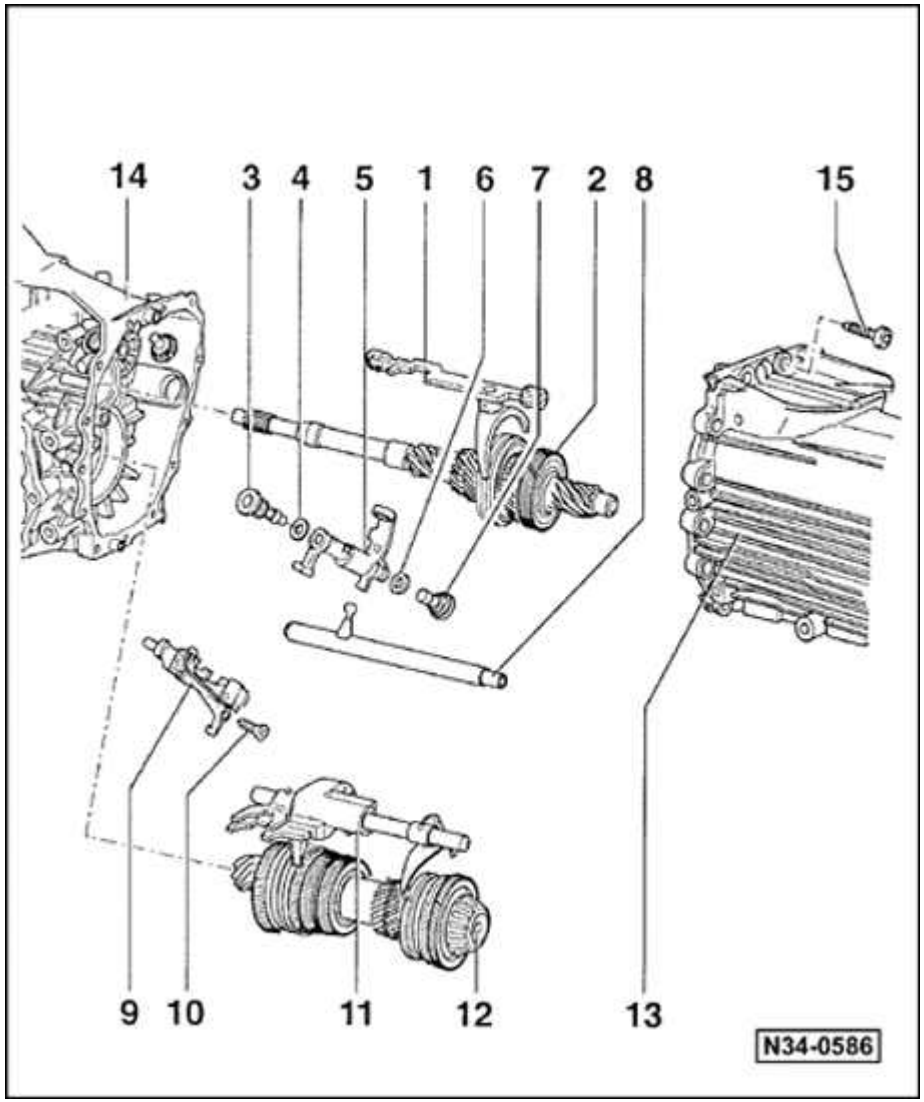


Fig. 1 Breather installation position

After pressing in, the breather must project 21 mm (0.83 in.) out of the housing.

34-45



Input shaft, pinion shaft, selector rods and transmission cover, removing and installing

1 - Shift rod with shift fork for 3rd and 4th gear

- Disassembling and assembling ⇒ Page 34-62
- Replacing bushings ⇒ Page 34-62

2 - Input shaft

- Disassembling and assembling ⇒ Page 35-1
- Adjusting ⇒ Page 35-17
- Servicing input shaft ball bearing ⇒ Page 35-17

3 - Left stop bolt

- 40 Nm (30 ft lb)

4 - Washer

5 - Relay shaft

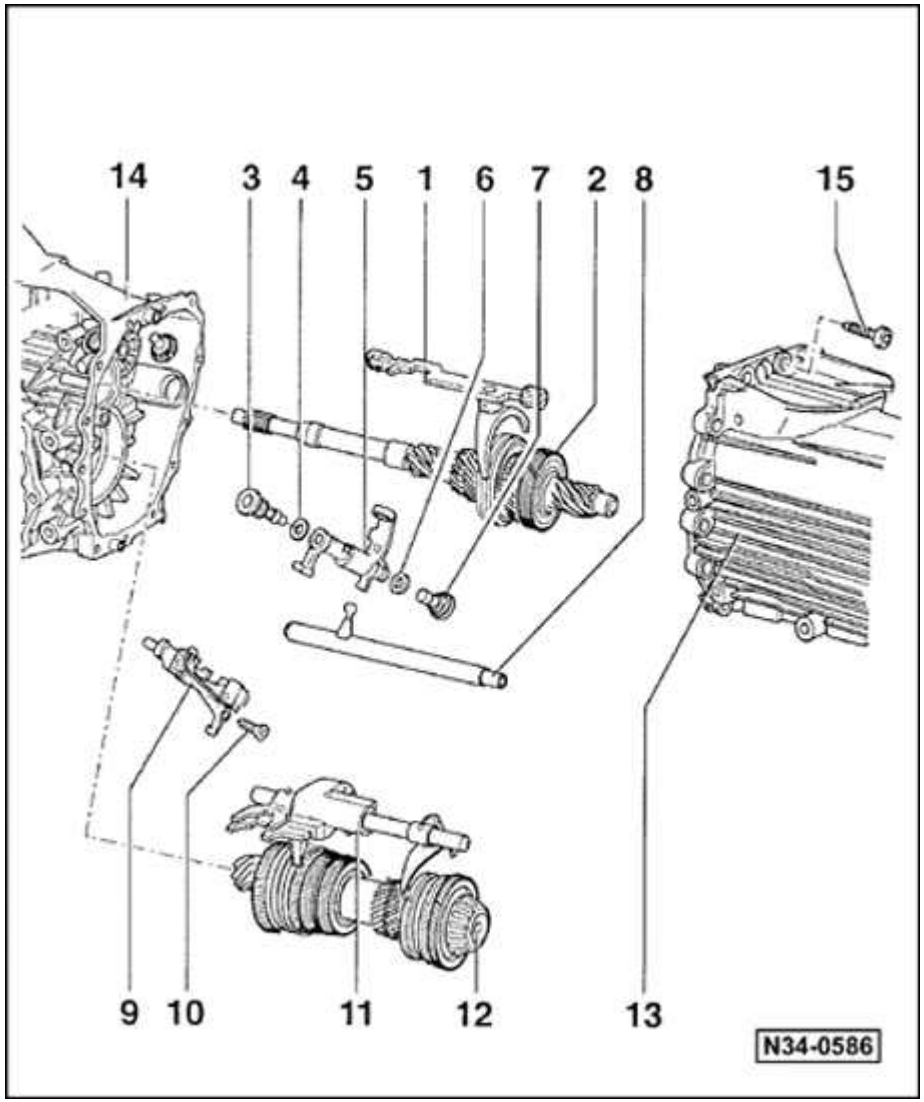
- Installation position ⇒ Page 34-62

6 - Washer

7 - Right stop bolt

- 40 Nm (30 ft lb)

34-46



8 - Shift rod

- Installation position ⇒ Page 34-62
- Replacing shift rod sealing washer ⇒ Page 34-62

9 - Shift detent

- Installation position ⇒ Page 34-62

10 - Torx® bolt

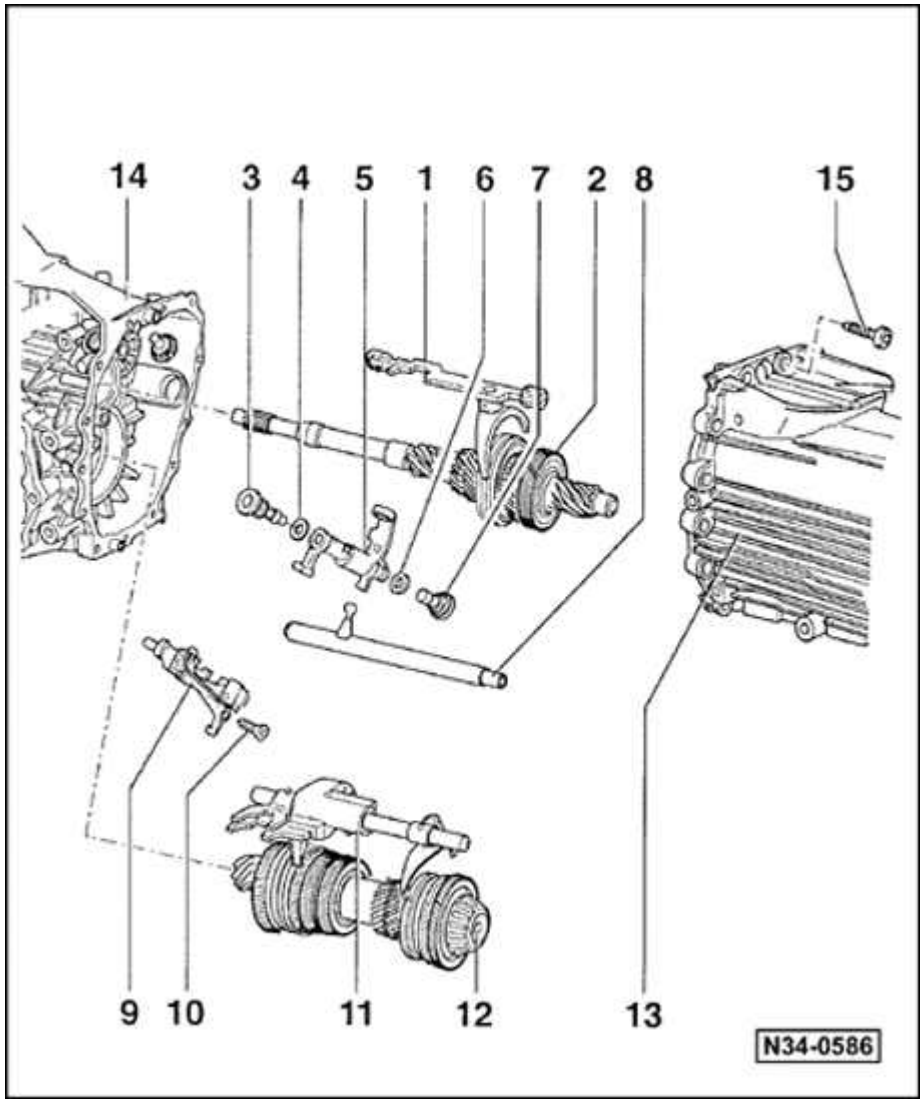
- 25 Nm (18 ft lb)
- With shoulder to secure shift detent spring

11 - Shift rod with shift fork for 1st/2nd/5th and reverse gear

- Disassembling and assembling ⇒ Page 34-62
- Removing and installing ball sleeve ⇒ Page 34-66 , ⇒ Fig. 2

12 - Pinion shaft

- Disassembling and assembling ⇒ Page 35-21
- Adjusting ⇒ Page 39-35
- Servicing pinion shaft ball bearing ⇒ Page 35-21



13 - Transmission cover

- Coat sealing surfaces with thin layer of sealant AMV 188 001 02
- Removing and installing oil collector tray ⇒ Page 34-48 , ⇒ Fig. 1

14 - Transmission housing

- Match components according to transmission code letters found in parts catalog microfiche

15 - Torx® bolt

- 22 Nm (16 ft lb)

34-48

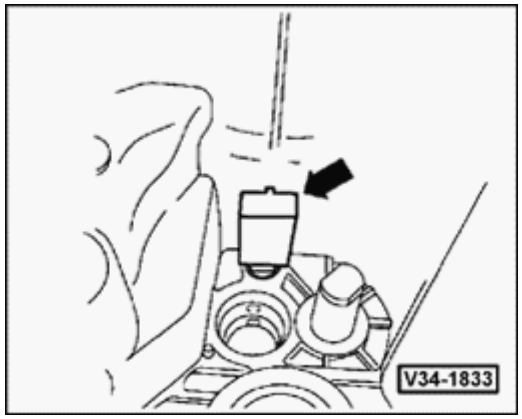


Fig. 1 Removing and installing oil collector tray

Removing

- Turn oil collector tray (arrow) and pull out.

Installing

- Push oil collector tray into transmission, until it snaps in.

  Installation position: oil collector tray faces upward in transmission cover.

34-49

Input shaft ball bearing, multi-function switch, input shaft, pinion shaft, shift rods and transmission cover, removing and installing

Notes:

- *To remove the above-mentioned components, it is not necessary to remove the differential.*
- *Removal is only necessary when adjustments have to be performed ⇒ Page 39-33 , list of adjustments*

Special tools and equipment

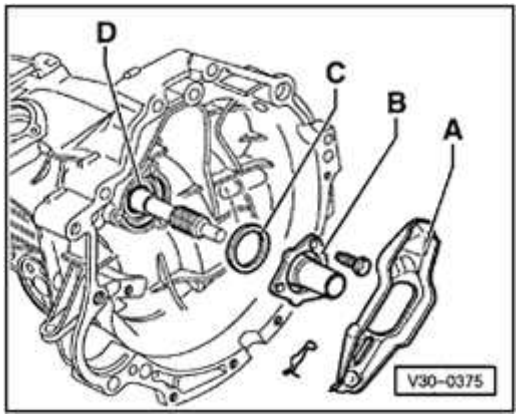
- VW309 holding plate
- VW353 transmission support
- 3235 press device
- VAG1306 drip tray
- VAG1582 taper roller bearing puller
- VAG1582/2 gripping piece

- AMV 188 001 02 sealant

34-50

Removing

- Place VAG1306 drip tray under transmission.
- Drain transmission oil.
- Secure transmission to assembly stand ⇒ Page 34-29 .



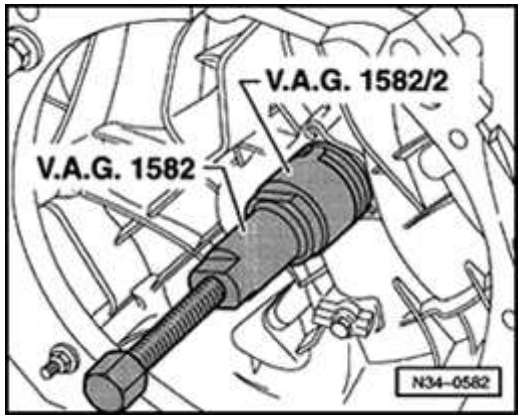
- Remove clutch release lever -A- with release bearing.

Notes:

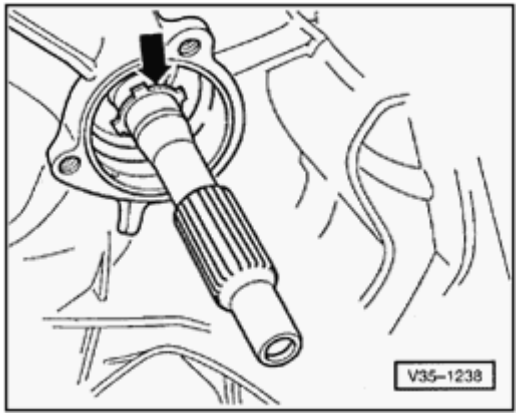
- *Before removing the guide sleeve, slide a shrink tube over the input shaft splines to protect the seal.*
- *Remove the seal in the guide sleeve ⇒ Page 30-18 .*

- Remove guide sleeve -B-.
- Remove spring washer -C-.
- Remove circlip -D- in front of input shaft ball bearing.
- Note thickness of circlip, if ball bearing, input shaft or transmission housing is not replaced.

34-51

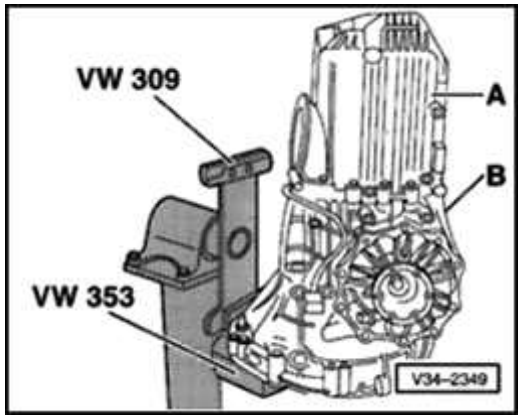


- Pull input shaft ball bearing out of transmission housing.

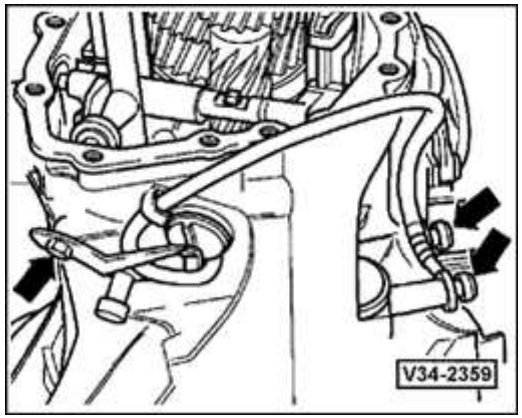


- Remove circlip (arrow) behind input shaft ball bearing.
- Note thickness of circlip, if ball bearing, input shaft or transmission housing is not replaced.

34-52

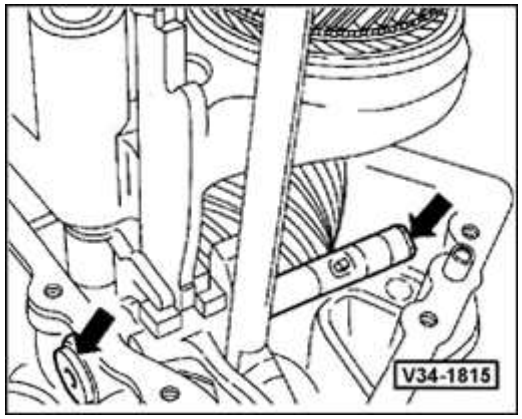


- Remove transmission cover -A- from transmission housing -B-.

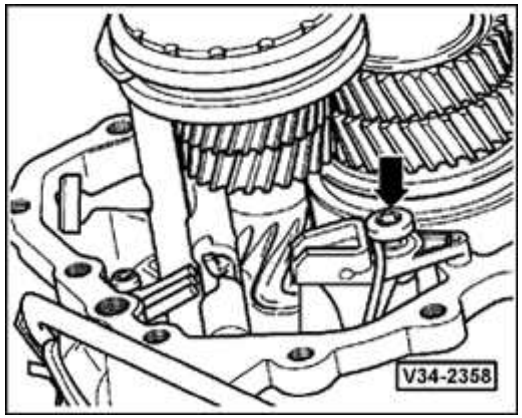


- Remove bolts (arrows) and pull out multi-function switch.

34-53

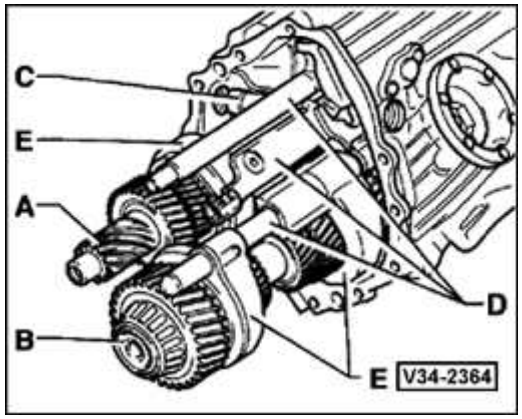


- Remove relay shaft bolts (arrows).



- Unbolt shift detent (arrow) and swing out.

34-54

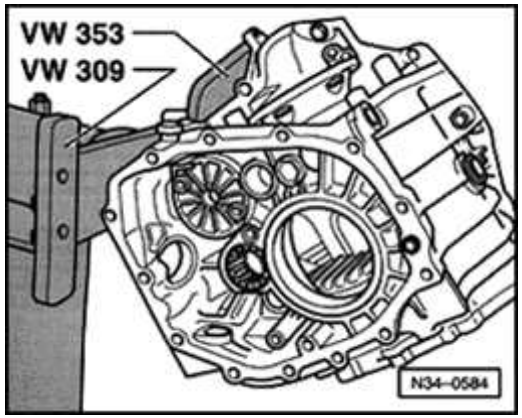


- Input shaft -A-, pinion shaft -B-, relay shaft -C-, selector rods -D- with shift rod and shift forks -E- must all be carefully pulled out together.

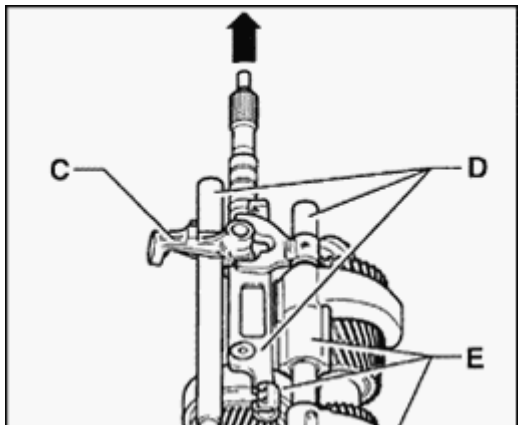
Installing

Note:

If the input shaft ball bearing, the input shaft or the transmission housing is replaced, it is necessary to re-determine the thickness of the circlips for the input shaft first ⇒ Page 35-17 , input shaft adjusting.



- For easier installation of following components, swing transmission housing into position shown.

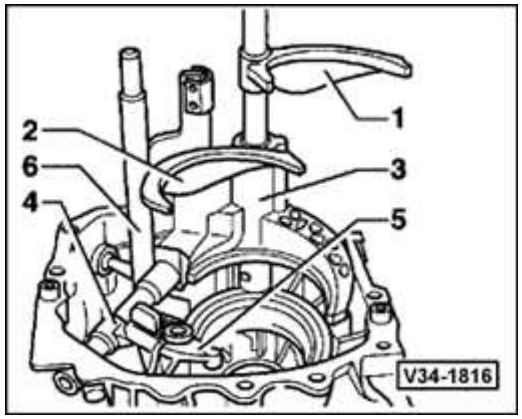


- Assemble input shaft -A-, pinion shaft -B-, relay shaft -C-, selector rods -D- with shift rod and selector forks -E-.
- Install these components into transmission housing as a set.

Note:

The relay shaft -C- and the shift rod can also be installed later if necessary ⇒ Page 34-56 , Illustration V34-1816 and ⇒ Page 34-57 , illustration V34-2120

34-56



➢ Position of shift mechanism in transmission

1 - Shift fork 5th and reverse gears

2 - Shift fork 3rd and 4th gears

3 - Shift fork 1st and 2nd gears

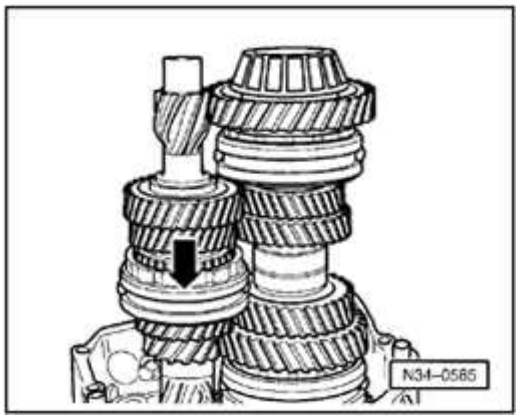
4 - Relay shaft

5 - Shift detent

6 - Shift rod

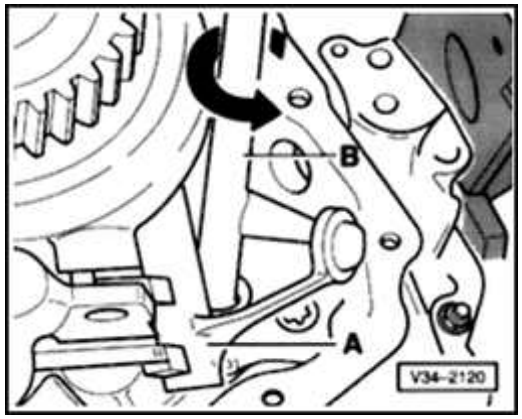
Note:

Illustration is shown without the drive axle and pinion.

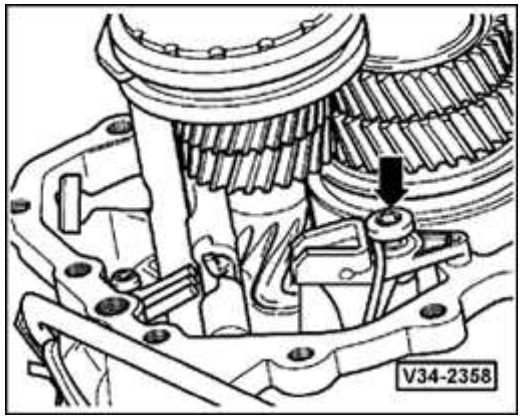


➢ - Move transmission housing and engage 3rd gear (direction of arrow).

34-57

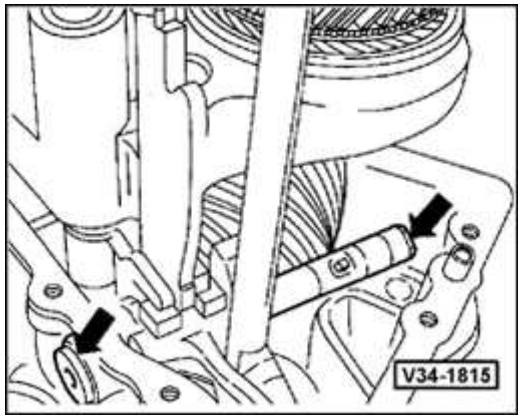


- Install relay shaft -A-.
- Place inner shift rod -B- sideways into mounting hole in transmission housing and assemble into mounting eye.
- Carefully turn shift rod in direction shown (arrow).

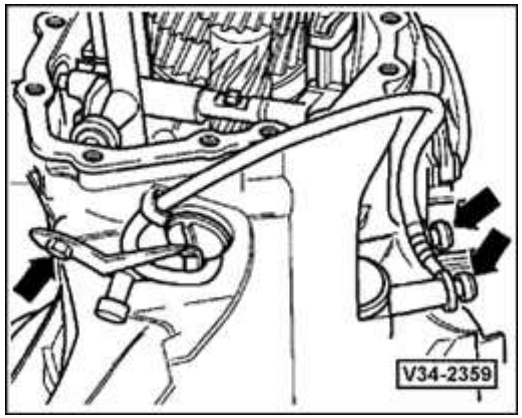


- Insert shift detent and tighten bolt (arrow) securely.

34-58

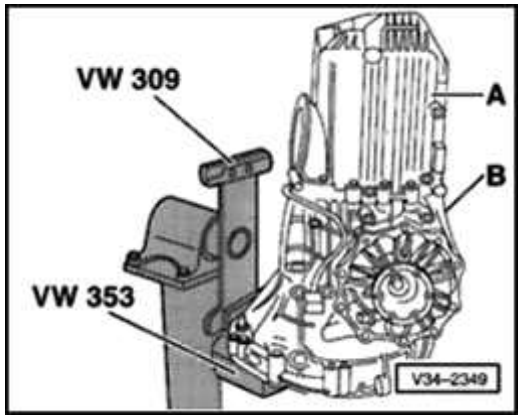


- Install relay shaft stop bolts (arrows).
- Replace O-ring for multi-function switch.

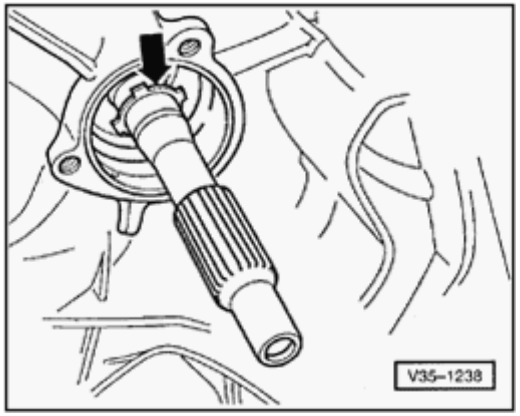


- Carefully insert multi-function switch and tighten (arrows).

34-59



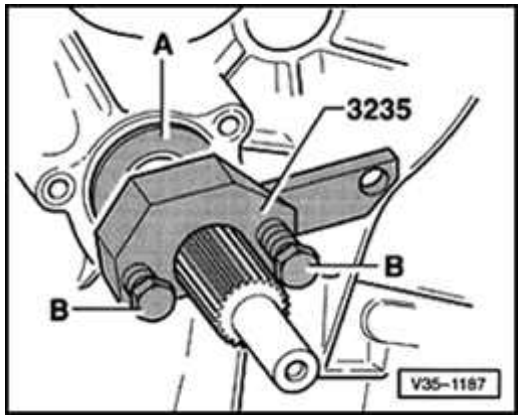
- Make sure dowel sleeves for transmission cover -A- are installed in transmission housing -B-.
- Coat sealing surfaces with a thin layer of sealant AMV 188 001 02.
- Install transmission cover onto transmission housing.



- Install rear circlip (arrow) for input shaft ball bearing.
- Slide ball bearing onto input shaft.

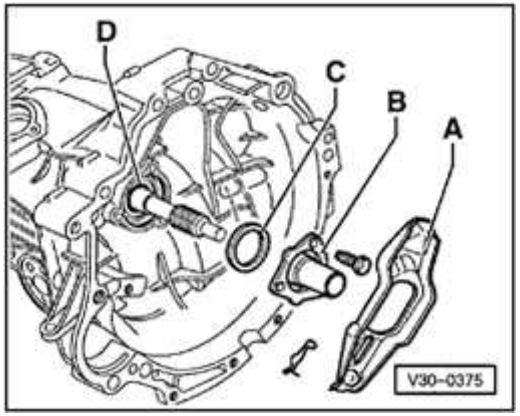
  Installation position: closed side of ball cage faces toward transmission housing.

34-60



- Press in ball bearing.
- Slide thrust piece -A- of press device onto input shaft.
- Position press device behind splines for clutch plate.
- Screw in bolts -B- and tighten slightly.

  The bolts bear against the indentations in thrust piece -A-.
- Press in ball bearing onto seat by alternately tightening bolts -B- (1/2-turn at a time) until stop is reached.



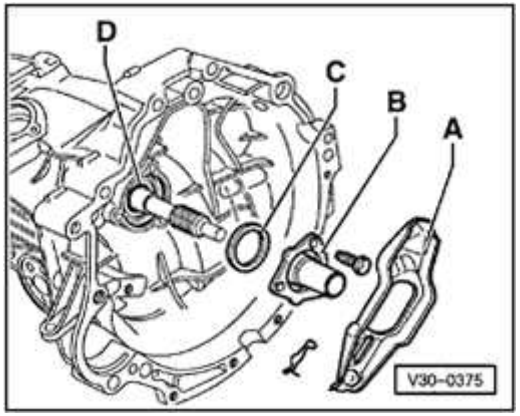
- Install front circlip -D- for input shaft ball bearing.
- Install spring washer -C-.

  Position: convex side faces guide sleeve -B-.

Notes:

- *Before installing guide sleeve, cover splines on input shaft with a shrink tubing to protect the seal.*
- *Installing seal in guide sleeve* ⇒ *Page 30-18* .

34-61



- Install guide sleeve -B- for throwout bearing.
- Install clutch release lever -A- and throwout bearing.

34-89

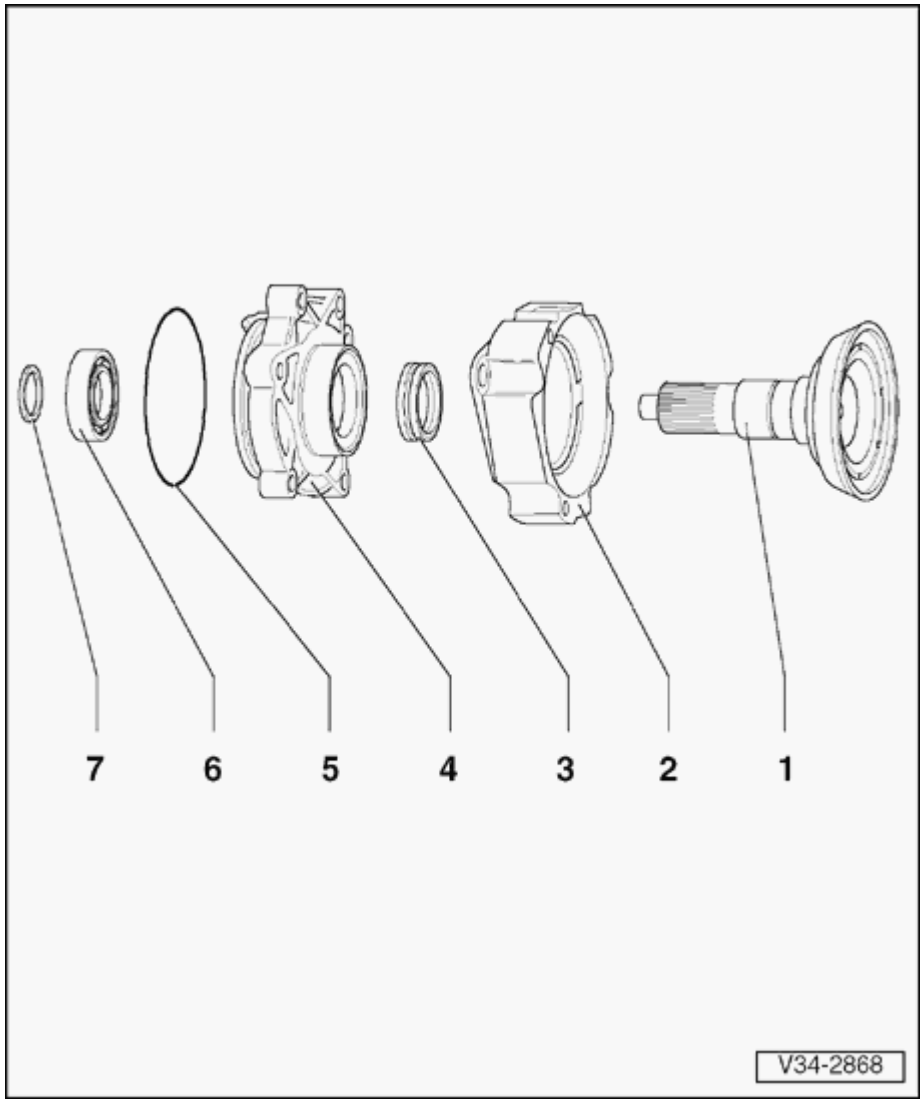
Bearing housing, disassembling and assembling

Special tools, testers and auxiliary items required:

- Adapter VW 295a
- Thrust plate VW 401
- Thrust plate VW 402
- Press tool VW 407
- Press tool VW 412
- Tube VW 415a
- Tube VW 416b
- Press tool VW 433
- Thrust pad VW 454
- Support rails VW 457

- Extractor lever VW 681
- Punch 2005
- Thrust pad 2007
- Shim, Part No. 016 311 391 B

34-90



1 - Drive flange

- Pressing out ⇒ Fig. 1
- Pressing in ⇒ Fig. 2

2 - Balance weight

- Pressing off ⇒ Fig. 3
- Pressing on ⇒ Fig. 4

3 - Seal

- Pulling out ⇒ Fig. 5
- Preparing for installation ⇒ Fig. 6
- Driving in ⇒ Fig. 7

4 - Bearing housing

5 - O-ring

- Always replace
- Lightly oil before installing

6 - Ball bearing for drive flange

- Pressing off ⇒ Fig. 8
- Pressing in ⇒ Fig. 9

7 - Circlip

34-91

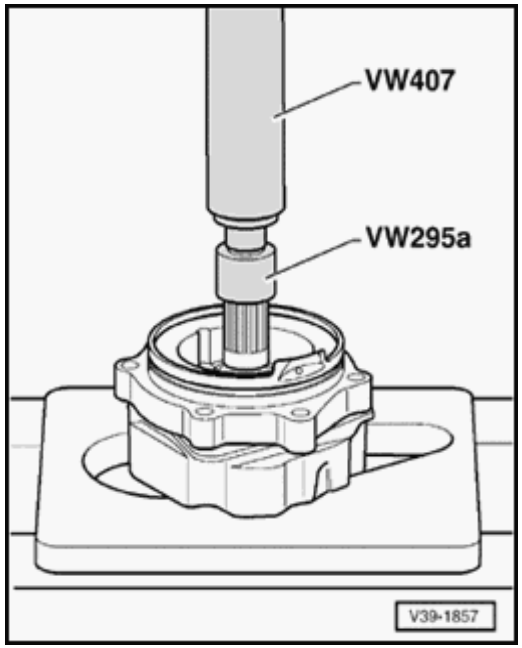


Fig. 1 Pressing out drive flange

- Before pressing out drive flange remove circlip.

34-92

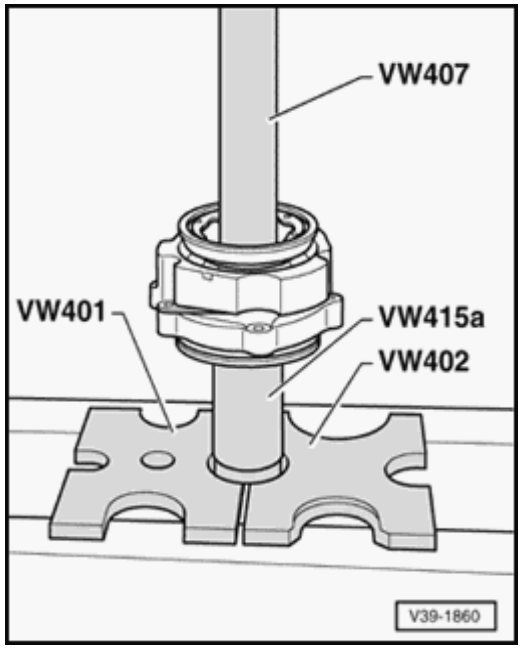


Fig. 2 Pressing in drive flange

- Before pressing in drive flange, press on balance weight ⇒ Fig. 4 .
- Fit circlip.

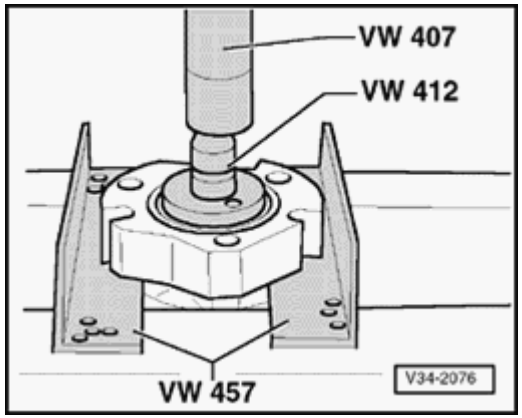


Fig. 3 Pressing off balance weight

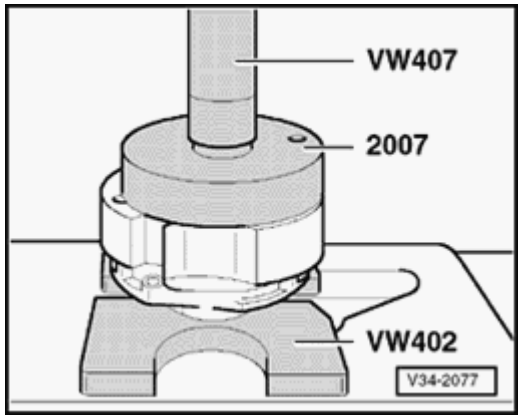


Fig. 4 Pressing on balance weight

Note:

Note position of holes.

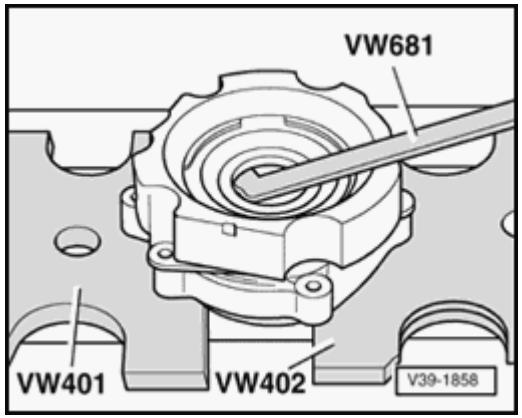


Fig. 5 Pulling out seal

34-94

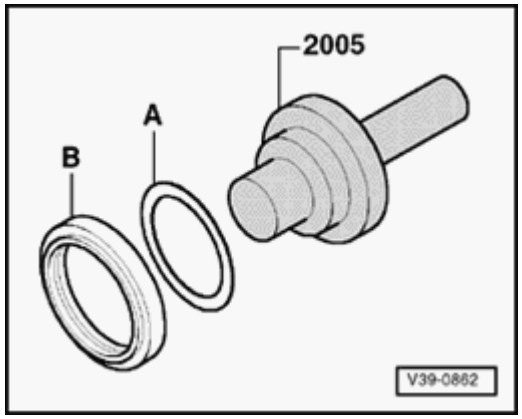


Fig. 6 Preparing seal for installation

A - Shim Part No. 016 311 391 B (1.7 mm thick)

B - Seal

- Fill space between sealing and dust lips with sealing grease G52 128 A1.
- Fit shim and seal onto tool one after the other.

  Installation position: open side of seal towards bearing housing

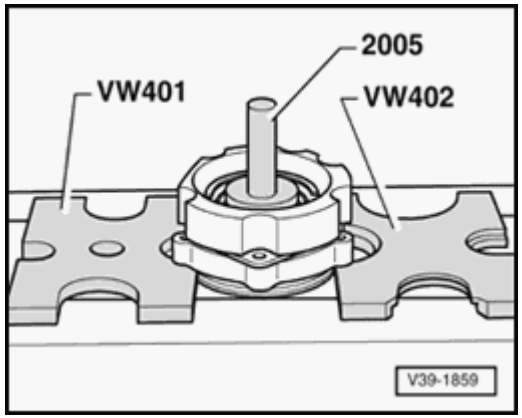


Fig. 7 Driving in seal

- Remove shim.

34-95

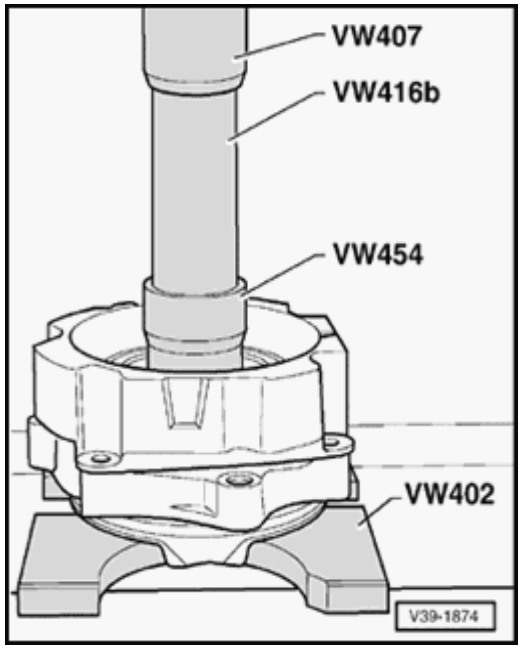


Fig. 8 Pressing out ball bearing for drive flange

34-96

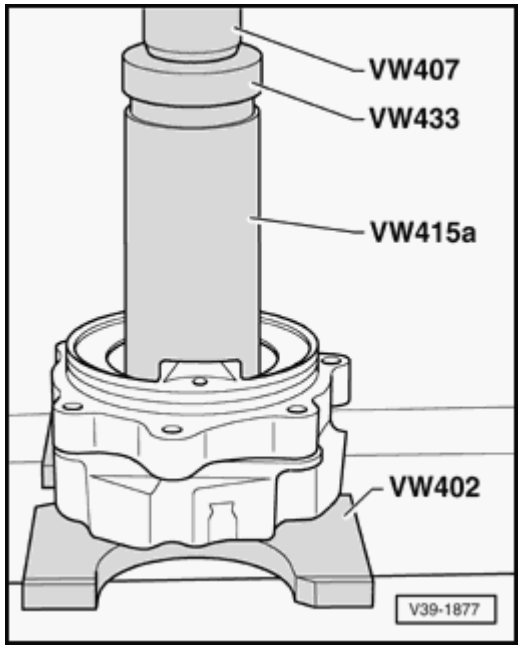


Fig. 9 Pressing in ball bearing for drive flange

34-97

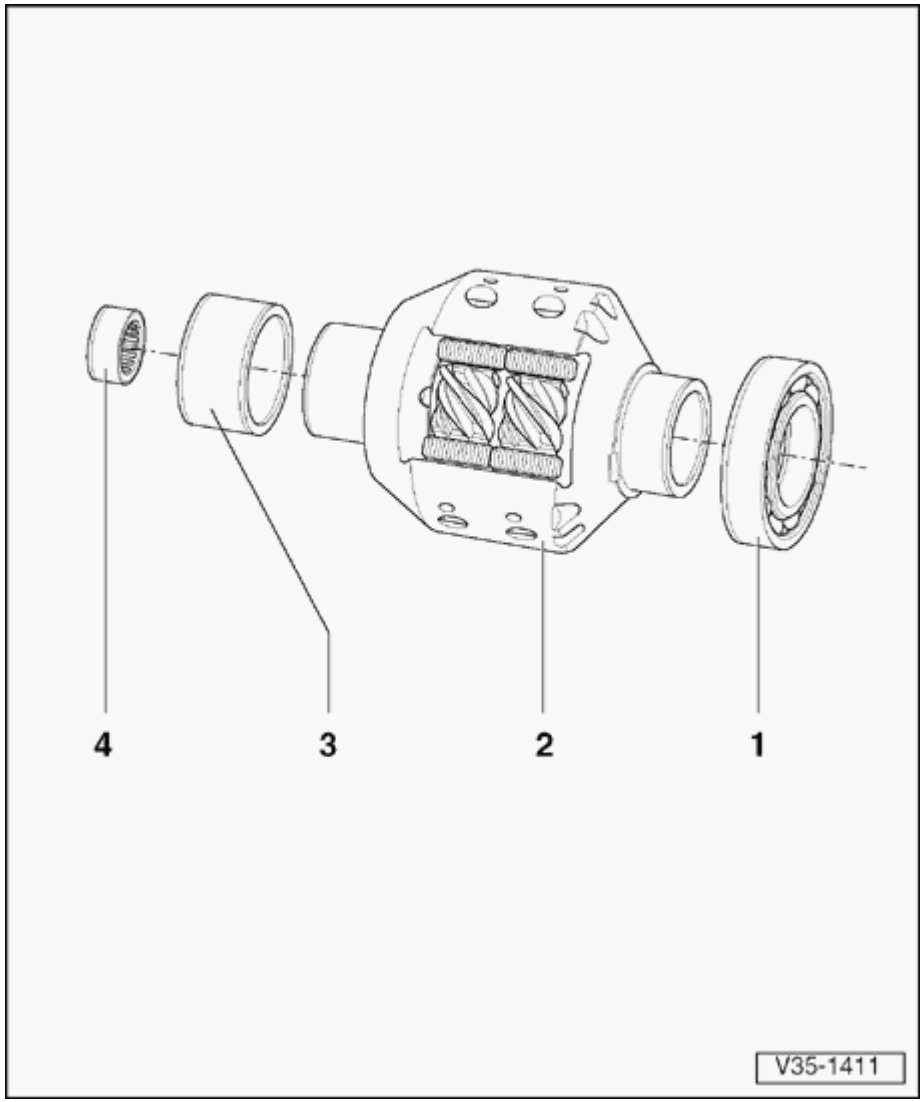
Bearings for Torsen differential, servicing

Special tools, testers and auxiliary items required:

- Thrust plate VW 401
- Thrust plate VW 402
- Press tool VW 407
- Press tool VW 412
- Press tool VW 432
- Thrust plate VW 447h
- Clamping sleeve 3116
- Thrust piece 3118
- Separating device 22-115 mm, e.g. Kukko 17/2
- Internal puller 30-37 mm, e.g. Kukko 21/5

- Counter support e.g. Kukko 22/1

34-98



1 - Ball bearing for Torsen differential

- Pressing off ⇒ Fig. 1
- Pressing on ⇒ Fig. 2

2 - Torsen differential

- Can only be serviced by manufacturer

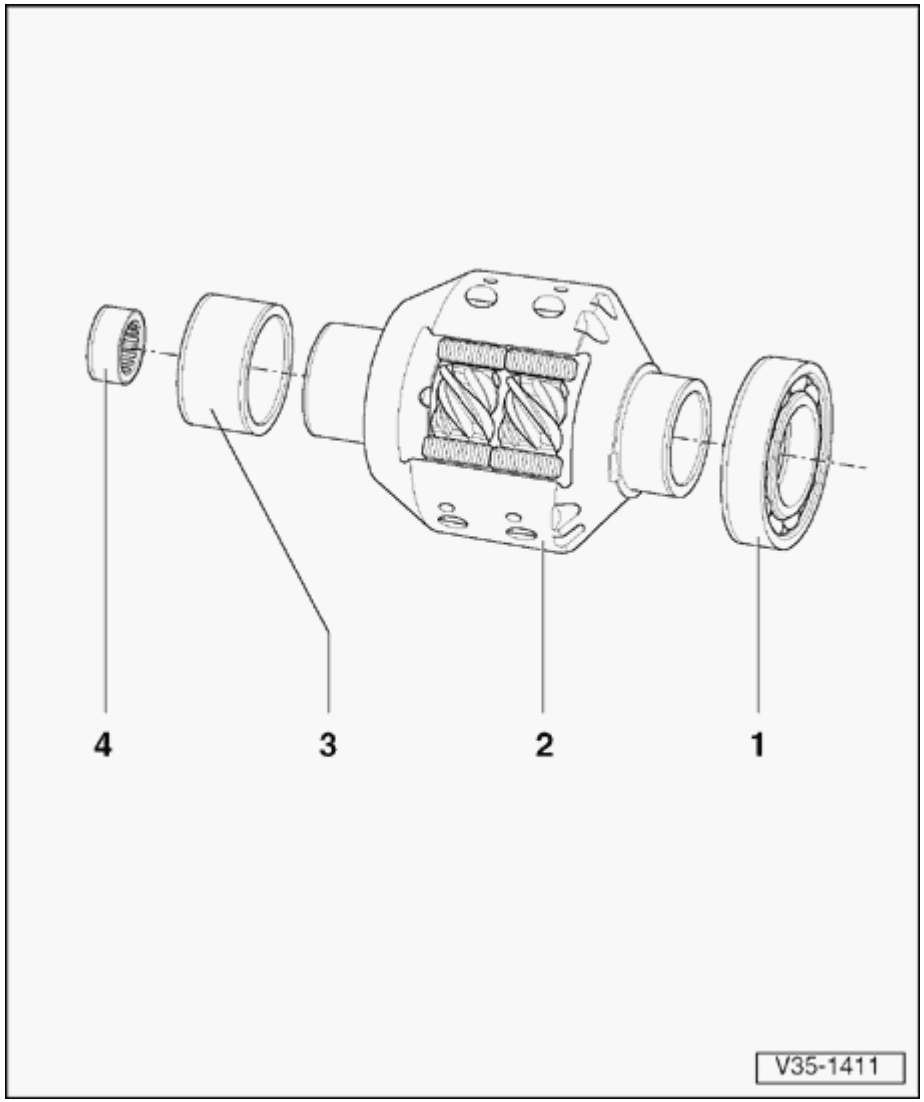
3 - Inner race for needle bearing for Torsen differential

- Pulling off ⇒ Fig. 3
- Pressing on ⇒ Fig. 4

4 - Needle bearing for drive pinion/Torsen differential

- Pulling out ⇒ Fig. 5
- Pressing in ⇒ Fig. 6

34-99



Note:

The shims for the Torsen differential must be re-determined after replacing the following parts ⇒ Page 34-85 :

- *End cover*
- *Inner race for needle bearing*
- *Torsen differential*
- *Ball bearing for Torsen differential*

34-100

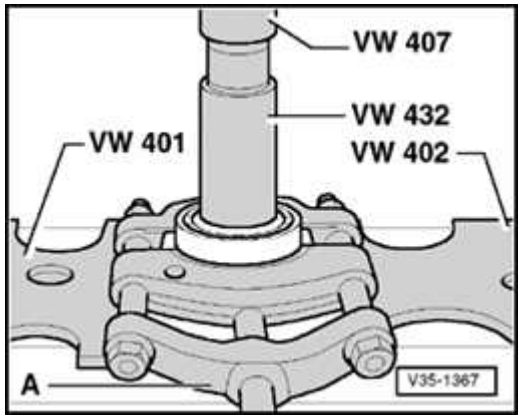


Fig. 1 Pressing off ball bearing for Torsen differential

A - Separating device 22-115 mm, e.g. Kukko 17/2

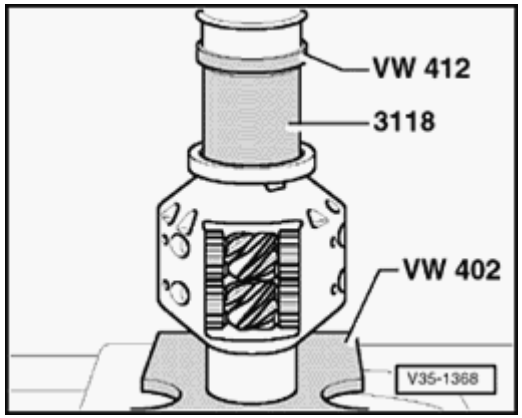


Fig. 2 Pressing on ball bearing for Torsen differential

- Press piece 3118 with shoulder towards press tool VW 412

34-101

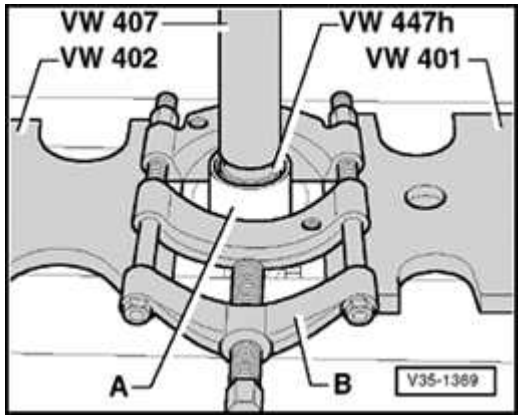


Fig. 3 Pulling off inner race for needle bearing for Torsen differential

A - Inner race

B - Separating device 22-115 mm, e.g. Kukko 17/2

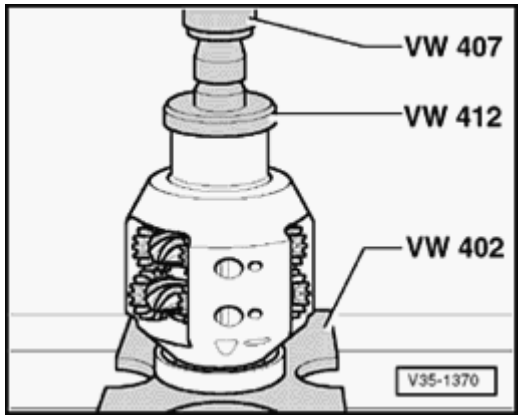


Fig. 4 Pressing on inner race for needle bearing for Torsen differential

34-102

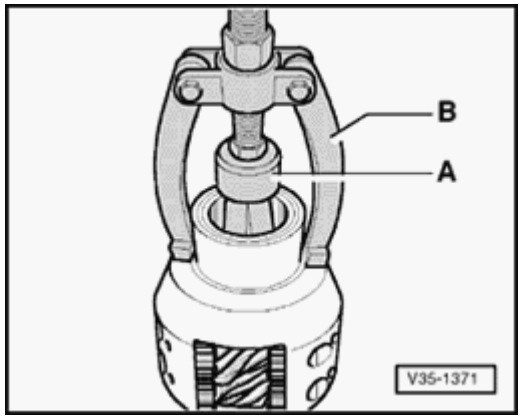


Fig. 5 Pulling out needle bearing for drive pinion/Torsen differential

A - Internal puller 30-37 mm, e.g. Kukko 21/5

B - Counter support, e.g. Kukko 22/1

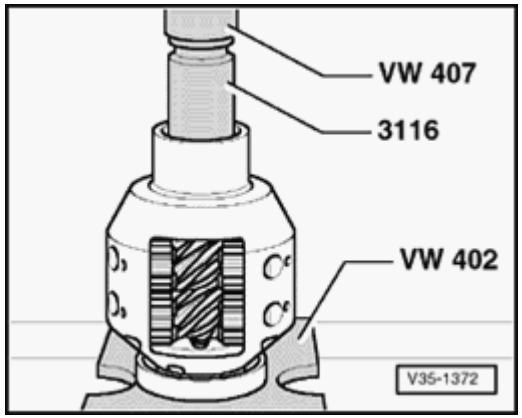


Fig. 6 Pressing in needle bearing for drive pinion/Torsen differential

- Press in needle bearing flush.

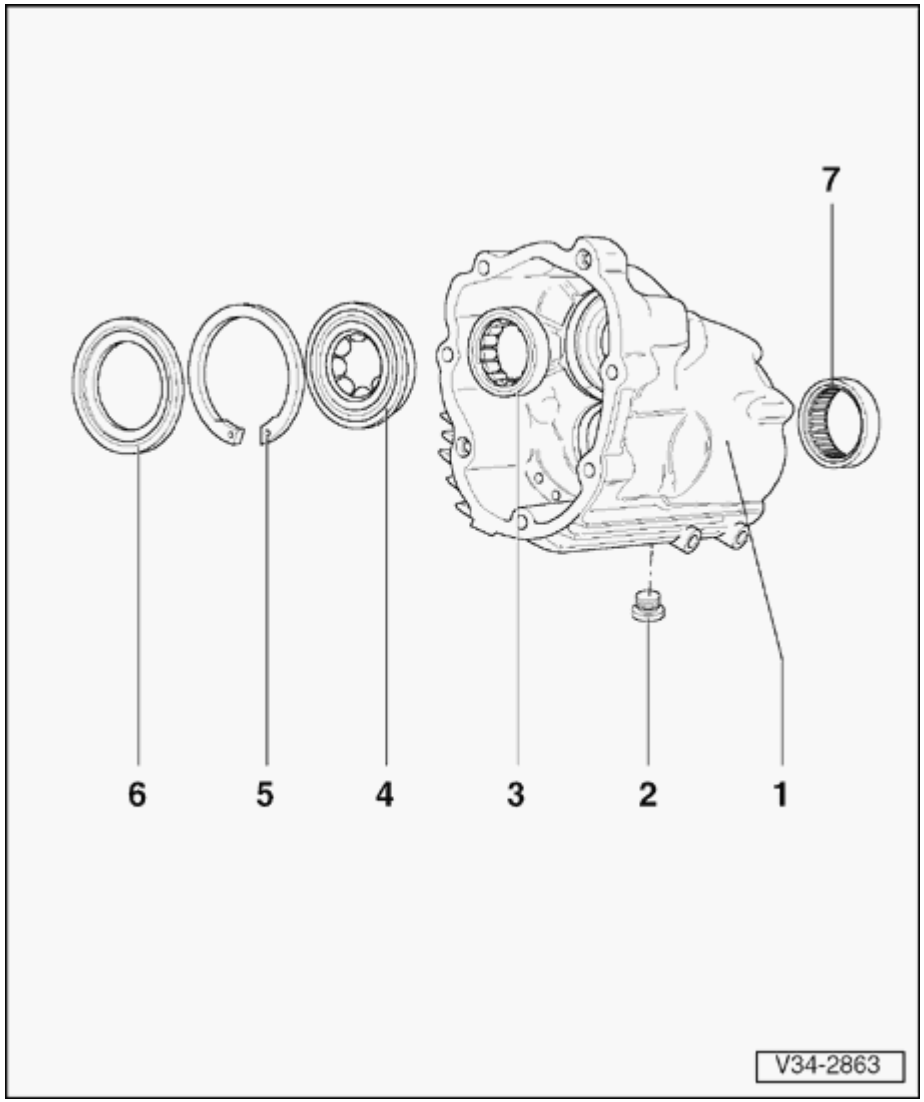
34-103

End cover, servicing

Special tools, testers and auxiliary items required:

- Thrust plate VW 401
- Press tool VW 407
- Press tool VW 412
- Tube VW 415a
- Spacer sleeve VW 472/2
- Thrust ring 2006A
- Internal puller 37-46 mm (e.g. Kukko 21/6)
- Internal puller 46-58 mm (e.g. Kukko 21/7)
- Counter support (e.g. Kukko 22/2)

34-104



1 - End cover

- If replaced:
  - Re-determine thickness of circlip - 5 -.
  - Re-determine shims for Torsen differential ⇒ Page 34-85 .

2 - Oil drain plug, 40 Nm

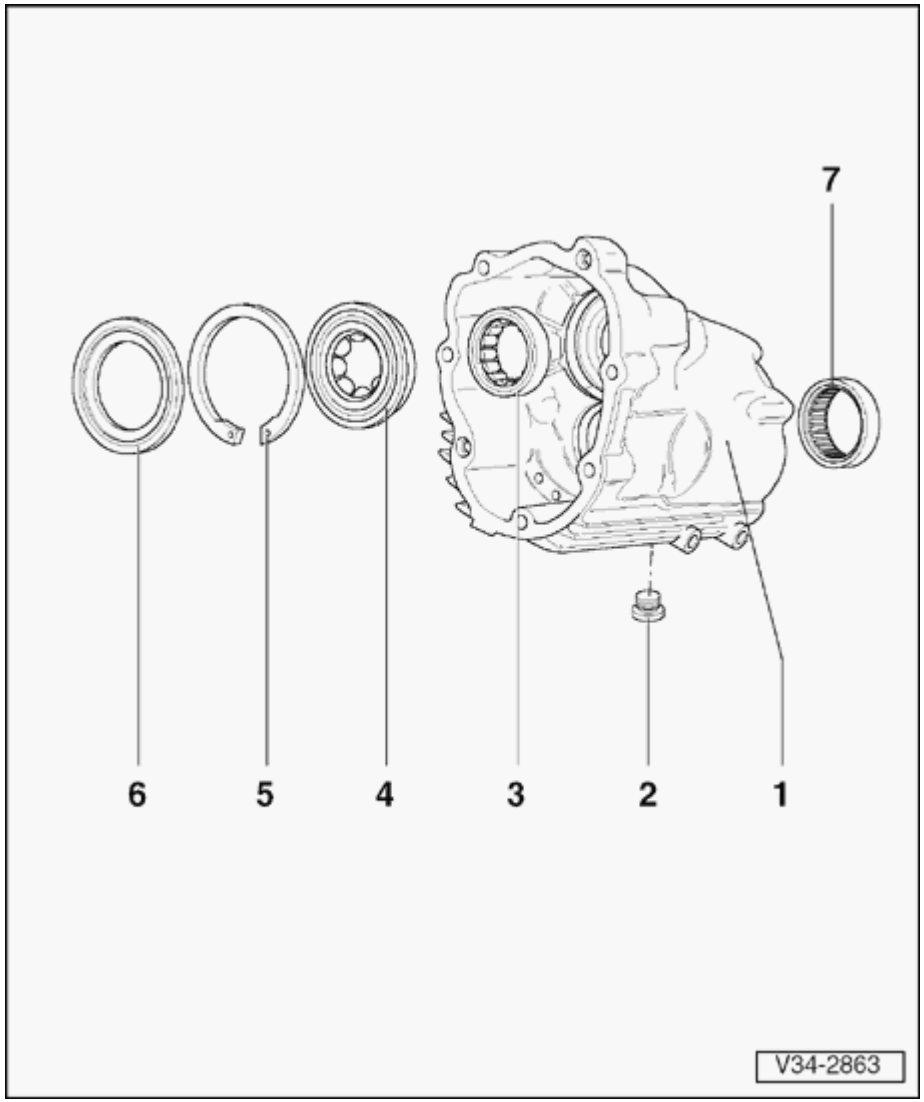
3 - Cylinder roller bearing for input shaft

- Pulling out ⇒ Fig. 1
- Pressing in flush ⇒ Fig. 2

4 - Ball bearing for input shaft

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4
- If replaced, re-determine thickness of circlip - 5 -

34-105



5 - Circlip

- Re-determine thickness ⇒ Page 34-108
- Installing ⇒ Fig. 4

6 - Baffle plate

- Replace
- Removing ⇒ Fig. 3
- Installing and peening in position when replacing ball bearing for input shaft ⇒ Fig. 5
- Installing and peening in position when replacing end cover ⇒ Fig. 6

7 - Needle bearing for Torsen differential

- Pulling out ⇒ Fig. 7
- Driving in ⇒ Fig. 8

34-106

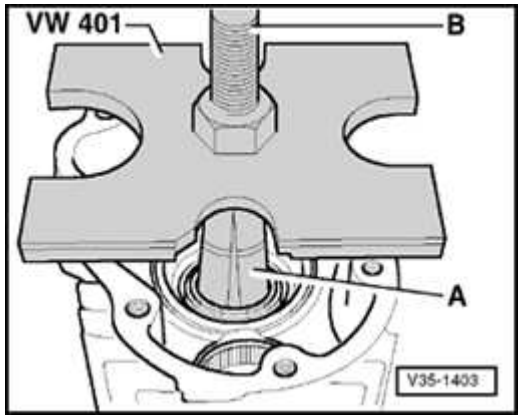


Fig. 1 Pulling cylinder roller bearing for input shaft out of end cover

A - Internal puller 37-46 mm, e.g. Kukko 21/6

B - Spindle from counter support Kukko 22/2

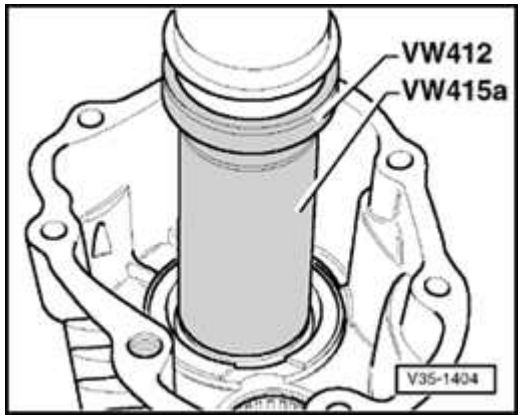


Fig. 2 Pressing cylinder roller bearing for input shaft flush into end cover

- Tube VW 415a with shoulder towards press tool VW 412

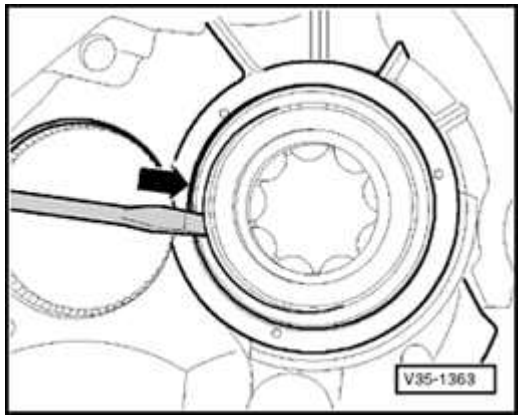


Fig. 3 Removing ball bearing for input shaft from end cover

- Position screwdriver as illustrated, drive into baffle plate (arrow) and pry out.
- Remove circlip.
- Take out bearing, remove peening indentations if necessary.

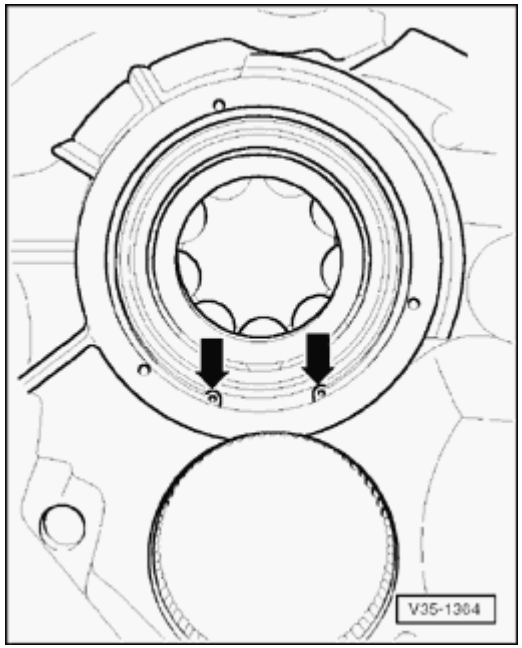


Fig. 4 Installing ball bearing for input shaft in end cover

Installation position of circlip:

- Ends of circlip (arrows), point towards needle bearing

Note:

The thickness of the circlip must be re-determined if the bearing or the end cover are replaced.

- Determine circlip for input shaft ball bearing:
  - Press ball bearing outer race onto stop.
  - Determine thickest circlip that can still just be fitted.

  Axial play: max. 0.08 mm

  - Determine circlip from table. Part numbers

⇒ *Parts catalog*

The following circlips are available:

Circlip thickness (mm)	
2.55	2.65
2.60	2.70

- Fit circlip.

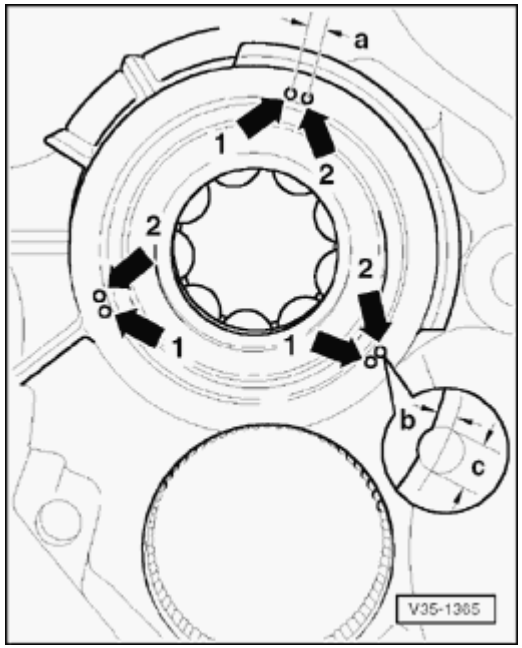


Fig. 5 Peening baffle plate in position when replacing ball bearing for input shaft

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle plate.
- Peen at points marked with -arrows 1-.
- Peen at points marked with arrows 2- at distance -a- from first position.
  - Dimension a = 5 mm
- Observe position and diameter of peening positions:
  - Dimension b = 2 mm
  - Dimension c = 3 mm

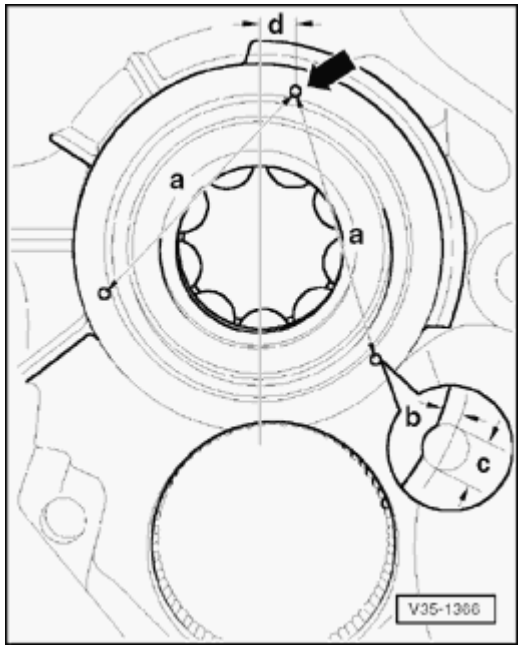


Fig. 6 Peening baffle plate in position when replacing end cover

- Use a blunt punch with a ball shaped end (ball diameter 5 mm) to peen in position.
- Insert baffle plate.
- Peen in first peening point (arrow) at distance -d- from center line of two shafts.
  - Dimension d = 10 mm
- Observe position and diameter of peening positions.
  - Dimension b = 2 mm
  - Dimension c = 3 mm
- Peen in second and third peening points in same manner at distance -a-.
  - Dimension a = 70 mm

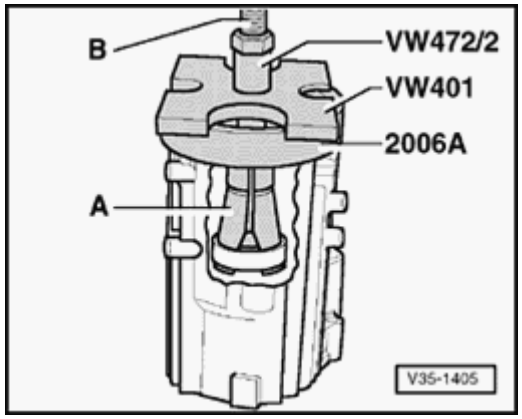


Fig. 7 Pulling needle bearing for Torsen differential out from end cover

A - Internal puller 46-58 mm, e.g. Kukko 21/7

B - Spindle from counter support Kukko 22/2

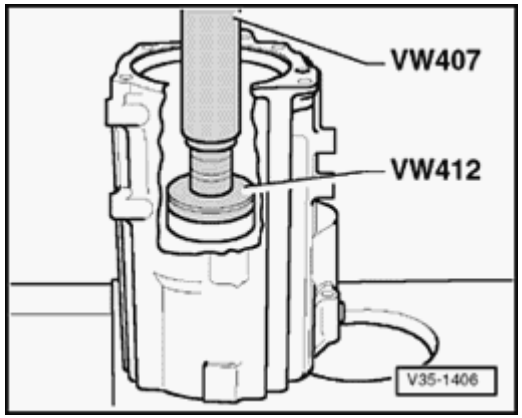


Fig. 8 Driving needle bearing for Torsen differential flush into end cover

- Fit press plate VW 412 onto bearing with shoulder facing up.

34-127

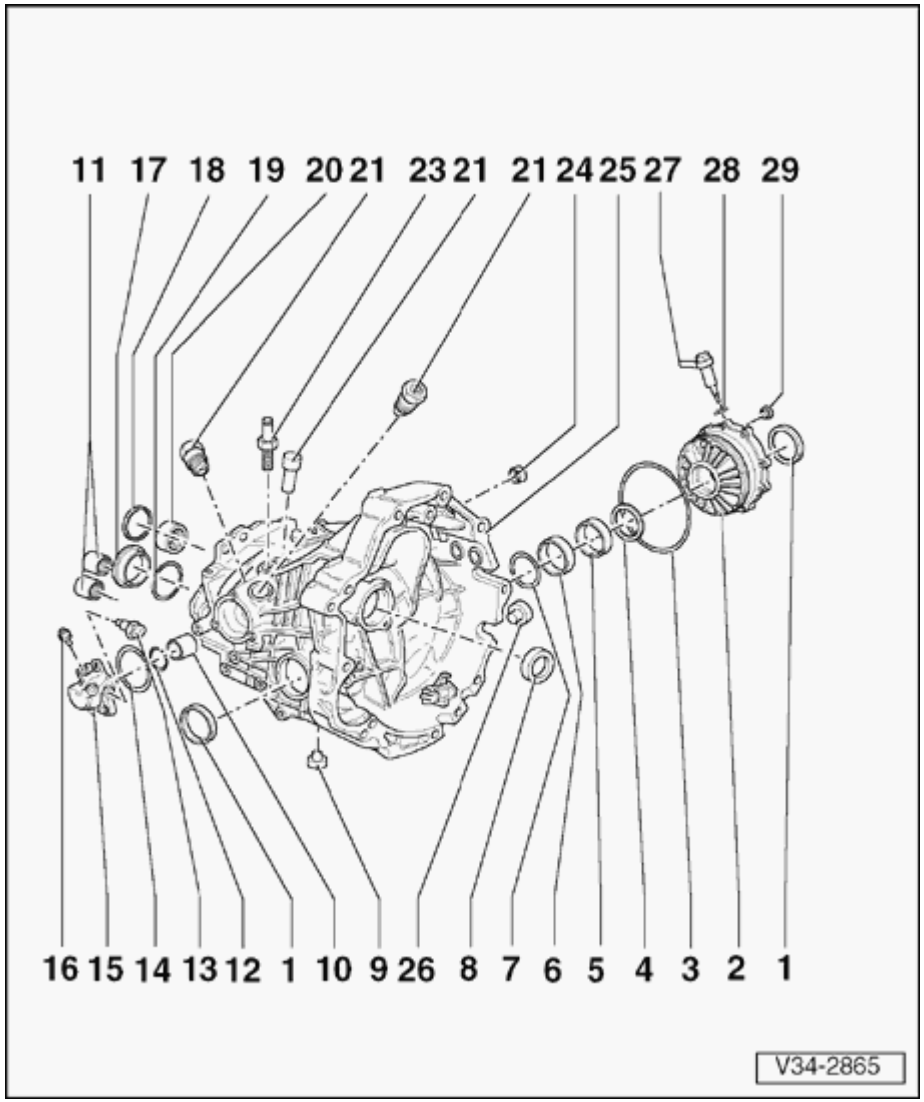
Transmission housing, servicing

Special tools, testers and auxiliary items required:

- Multi-purpose tool 771/1 with attachment 771/15
- Mandrel 2062
- Press tool VW 408 A
- Tube VW 423
- Thrust pad VW 454
- Extractor lever VW 681
- Guide pin 10-15
- Drift sleeve 30-100
- Mandrel 30-505
- Installing tool 40-503

- Internal puller 14.5-18.5 mm e.g. Kukko 21/2
- Internal puller 30-37 mm e.g. Kukko 21/5
- Depth gauge
- Assembly sleeve, Part No. 01E 311 120

34-128



Note:

- *Refer to general repair instructions ⇒ Page 00-11 .*
- *Adjustments are required when replacing components marked 1) ⇒ Page 39-37 , adjustment overview.*

1 - Seal

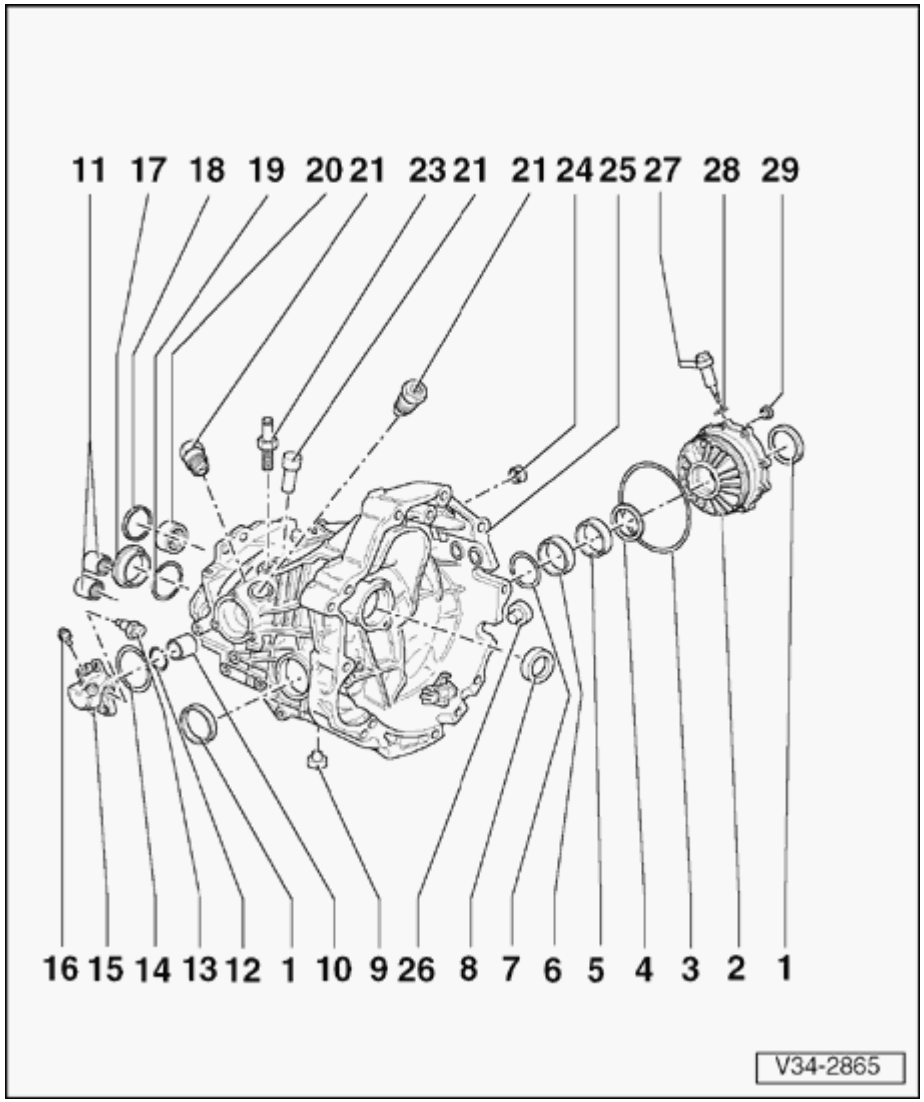
- For drive flange
- Pulling out ⇒ Fig. 1
- Driving in ⇒ Fig. 2
- Fill space between sealing lips with sealing grease G52 128 A1.
- Replacing with transmission installed ⇒ Page 39-1

2 - Final drive cover 1)

3 - O-ring

- For cover for final drive
- Always replace

34-129



4 - Shim "S1"

- Note thickness
- Adjustment overview ⇒ Page 39-37

5 - Outer race for large tapered roller bearing
1)

- For differential
- Driving out and driving in ⇒ Page 39-32

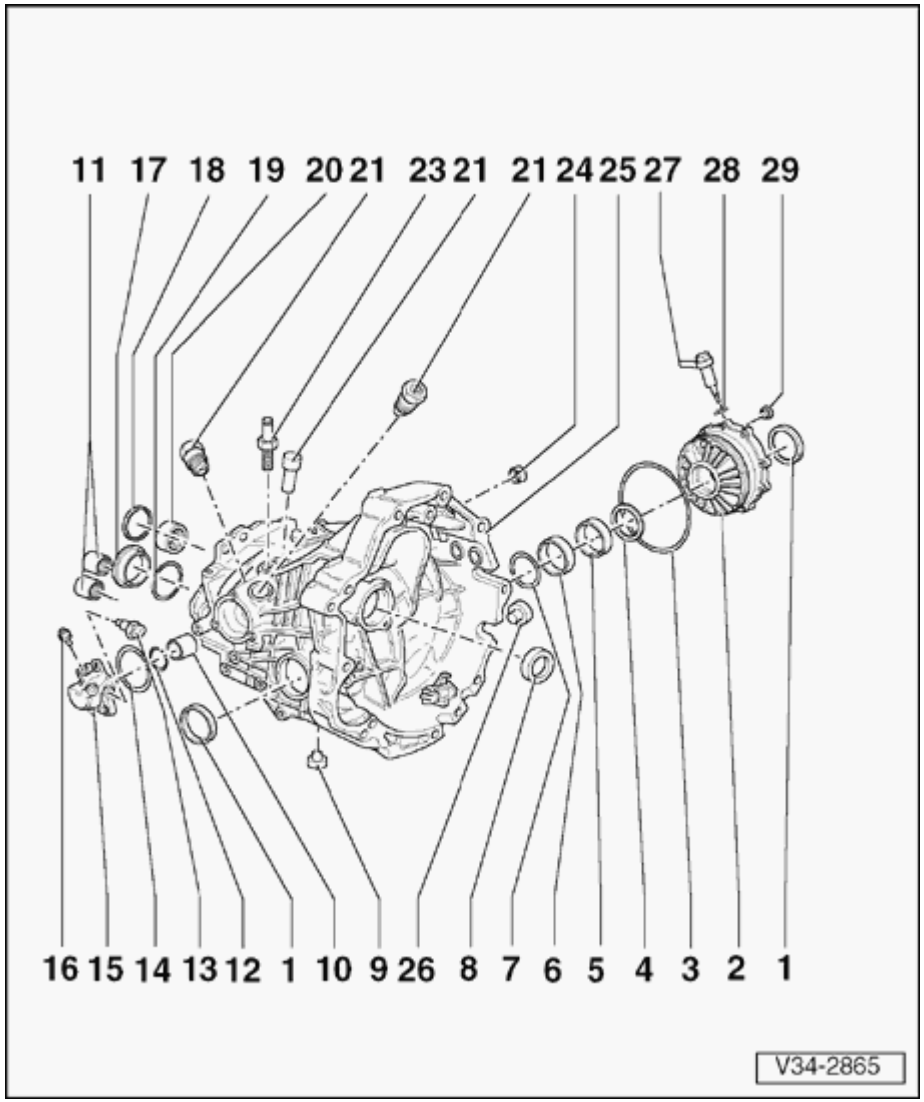
6 - Outer race for small tapered roller bearing
1)

- For differential
- Driving out and driving in ⇒ Page 39-31

7 - Shim "S2"

- Note thickness
- Adjustment overview ⇒ Page 39-37

34-130



8 - Seal

- For input shaft
- Prying out ⇒ Fig. 3
- Driving in ⇒ Fig. 5
- Always replace when removing input shaft
- Replacing when transmission is not disassembled ⇒ Fig. 4 and ⇒ Fig. 5

9 - Oil drain plug, 40 Nm

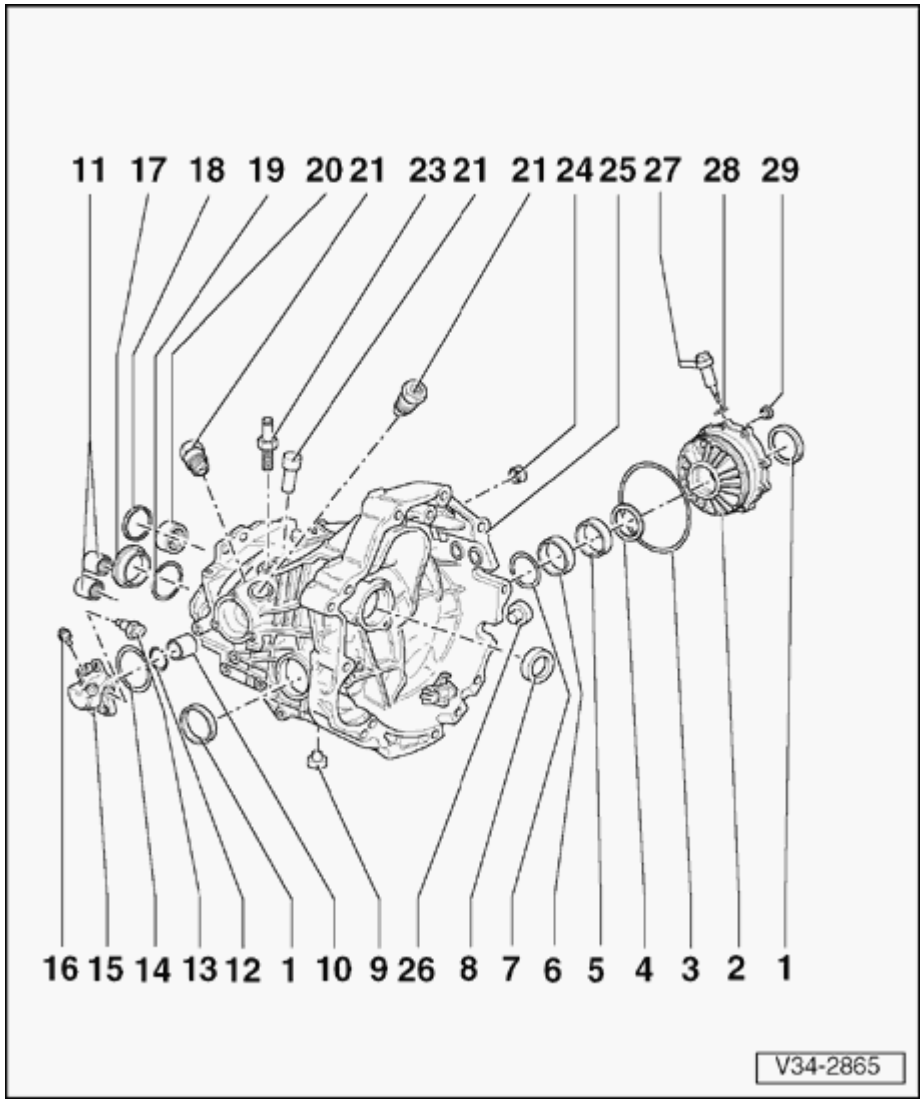
10 - Ball sleeve

- For selector shaft
- Replace
- Pulling out ⇒ Fig. 6
- Driving in ⇒ Fig. 7

11 - Ball sleeves

- For selector shafts
- Replace
- Pulling out, as - 10 - ⇒ Fig. 6
- Driving in, as - 10 - ⇒ Fig. 7

34-131



12 - Circlip

- Installation position: eyes facing up

13 - Switch for back-up lights, 20 Nm

14 - O-ring

- For cover for selector shaft
- Always replace

15 - Cover for selector shaft

- Removing ⇒ Page 34-59
- Installing ⇒ Page 34-85

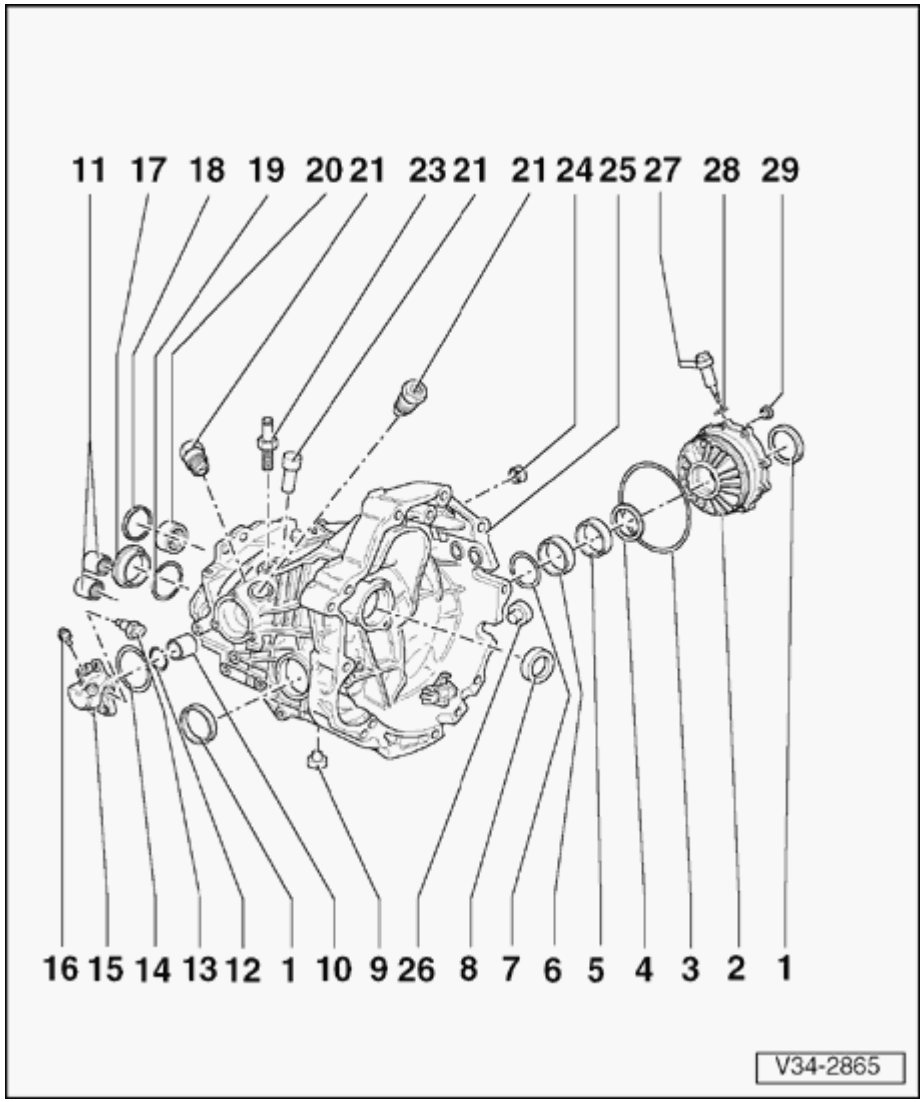
16 - Ball stud, 20 Nm

- For connecting rod

17 - Outer race for large tapered roller bearing **1)**

- For drive pinion
- Pulling out ⇒ *Fig. 1* , ⇒ Page 35-22
- Pressing in ⇒ *Fig. 2* , ⇒ Page 35-22 and ⇒ *Fig. 3* , ⇒ Page 35-23

34-132



18 - Circlip

- Removing ⇒ Fig. 16

19 - Shim "S3"

- Note thickness
- Adjustment overview ⇒ Page 39-37

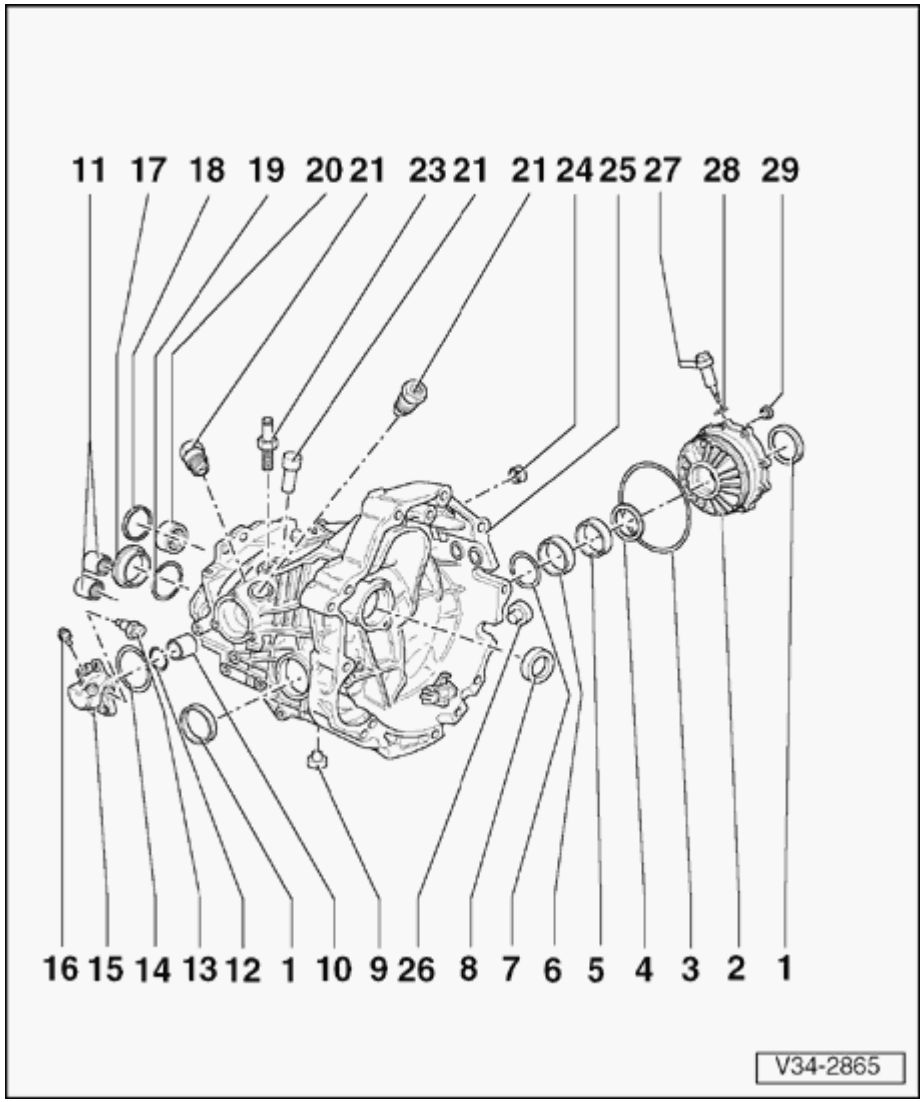
20 - Needle bearing

- For input shaft
- Pulling out ⇒ Fig. 13
- Driving in ⇒ Fig. 14
- Measuring insertion depth ⇒ Fig. 15

21 - Locking bolt

- For selector shaft
- Removing ⇒ Page 34-59
- Installing ⇒ Page 34-85
- Tightening torques: For aluminium bolt = 50 Nm, and for steel bolt = 70 Nm

34-133



22 - Breather

- Clip cap on
- For transmission with sleeve insertion depth of sleeve ⇒ Fig. 11
- For transmission with with additional breather hose ⇒ Fig. 12

23 - Trunnion bolt, 40 Nm

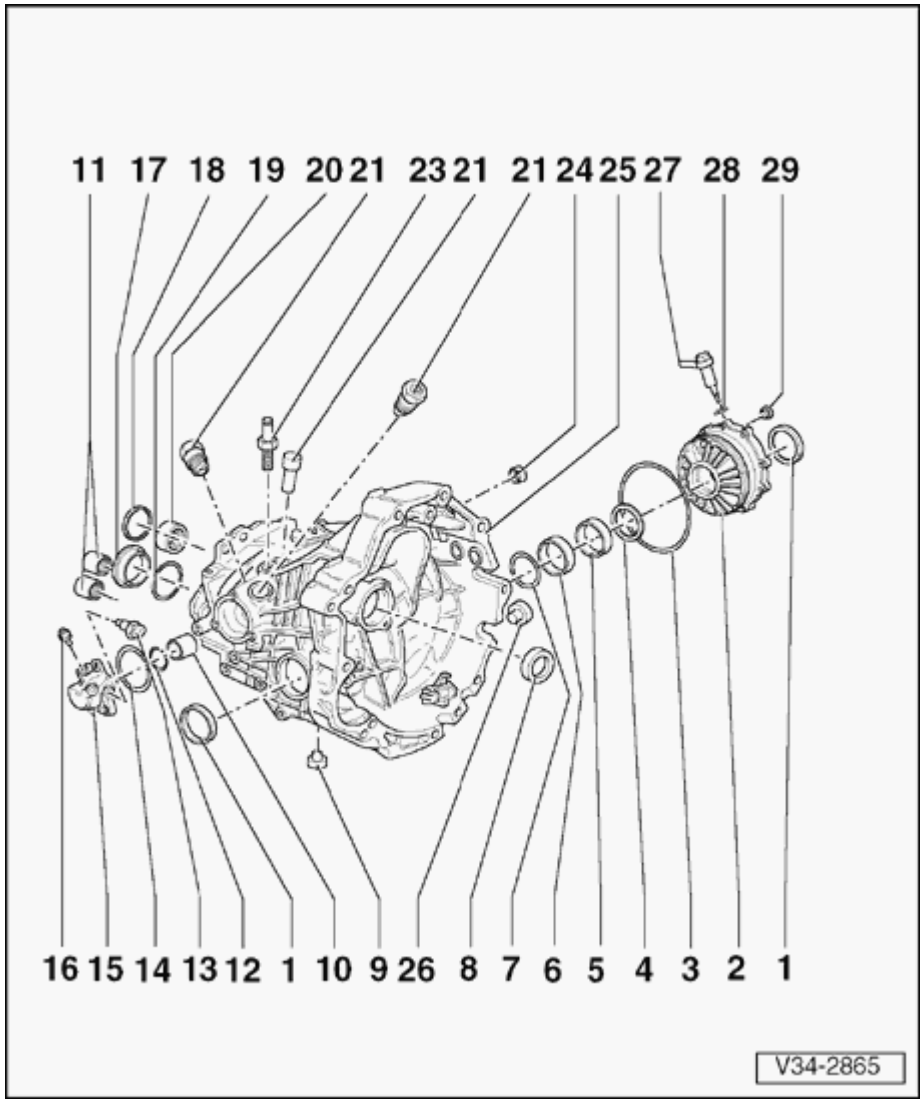
- For push rod

24 - Seal for selector shaft

- Can be replaced when transmission is removed but not disassembled
- Always replace
- Pulling out ⇒ Fig. 8
- Driving in ⇒ Fig. 9
- Always use assembly sleeve for installing ⇒ Fig. 10

25 - Transmission housing [1)]

34-134



26 - Magnet

- Clean
- When replacing transmission housing drive in with e.g. press tool VW 408 A

27 - Sender for speedometer -G22-

- Replacing ⇒ Page 39-4

28 - O-ring

- Always replace

29 - Oil filler plug, 40 Nm

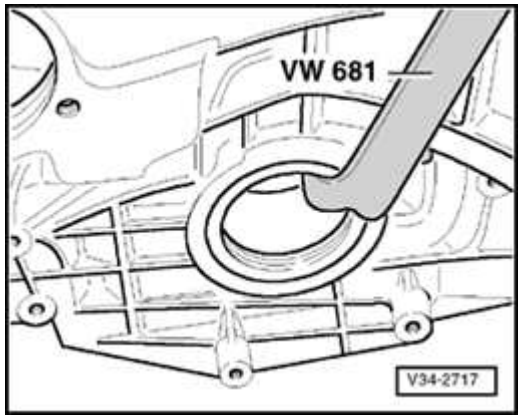


Fig. 1 Pulling out seal for drive flange

Note:

- *Illustrated, removing oil seal on right-hand side.*
- *Procedure for removing oil seal on left and right-hand sides is identical.*

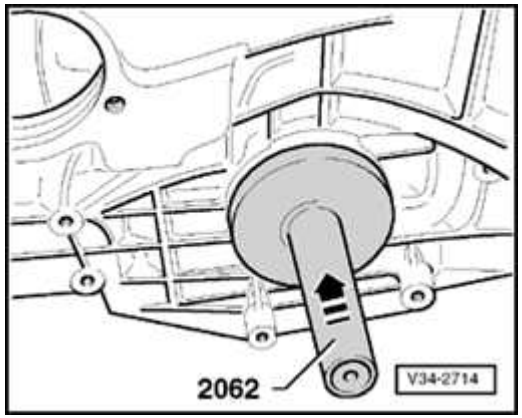


Fig. 2 Driving in seal for drive flange

- Fill space between sealing lip and dust lip with sealing grease G52 128 A1.

- Pressing-in depth (factory): 5.5 mm
- Pressing-in depth when re-installing a used drive flange (repairs): 6.5 mm

Note:

- *Illustrated, installing oil seal on right-hand side.*
- *Procedure for installing oil seal on left and right-hand sides is identical.*

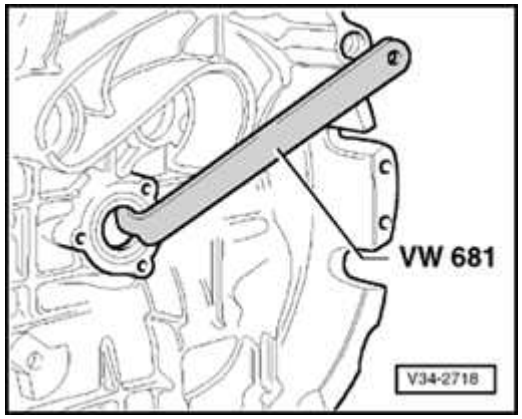


Fig. 3 Prying out seal for input shaft when transmission is dismantled

- Pry out seal carefully with VW 681.

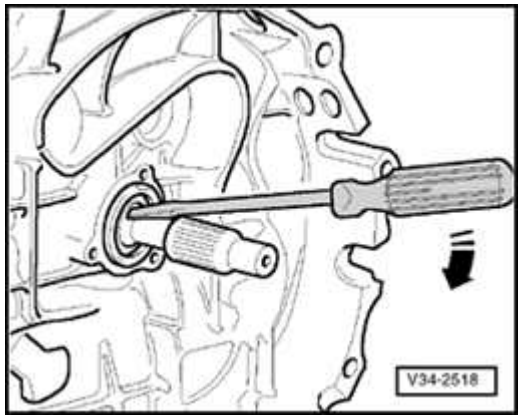


Fig. 4 Removing seal for input shaft when transmission is not dismantled

- Pry out seal carefully with a screwdriver.

Note:

Do not damage bearing surface on input shaft for shaft seal.

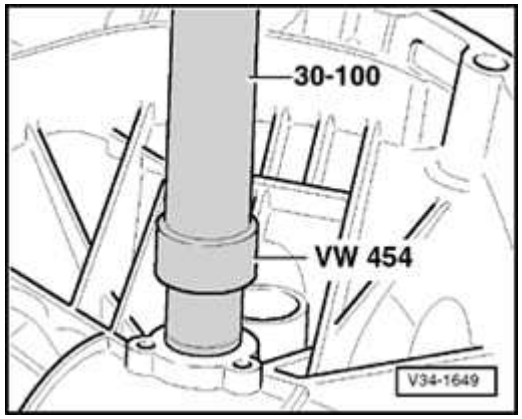


Fig. 5 Driving in seal for input shaft

- Fill space between sealing lip and dust lip of new seal for input shaft with sealing grease G52 128 A1.
- Fit a thin protective hose tightly over splines of input shaft.
- Drive in seal for input shaft.
  - ♦ Pressing-in depth (factory): 3.5 mm
  - ♦ Pressing-in depth when re-installing a used input shaft (repairs): 4.5 mm
- Remove protective hose.

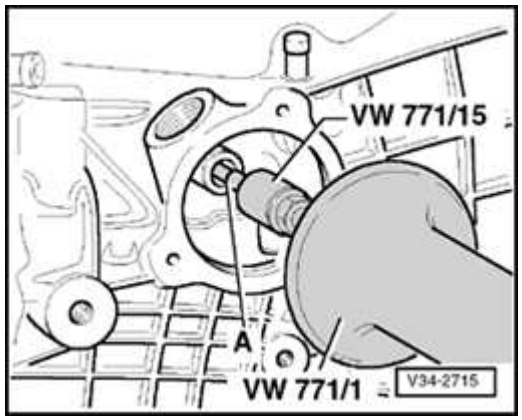


Fig. 6 Pulling out ball sleeve

- Remove circlip.

A - Internal puller 14.5-18.5 mm, e.g. Kukko 21/2

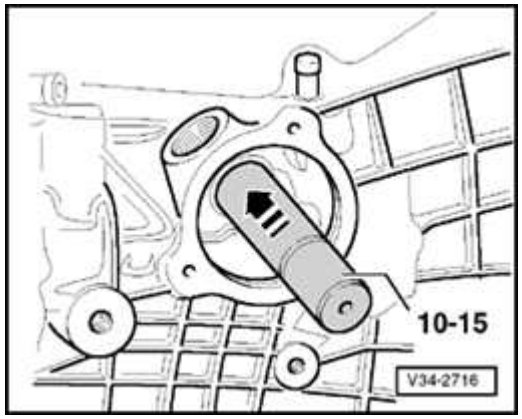


Fig. 7 Driving in ball sleeve

- Drive in onto stop.

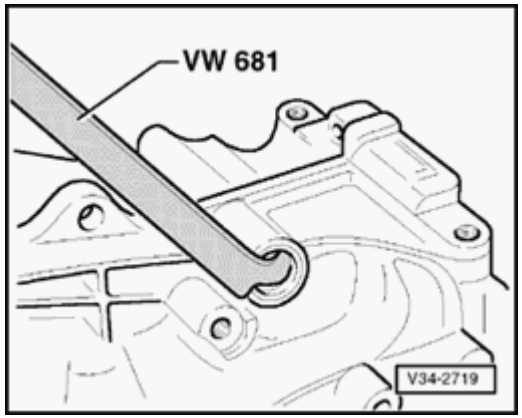


Fig. 8 Pulling out seal for selector shaft

Note:

With transmission removed but not disassembled, carefully pry out seal without damaging the shaft with a screwdriver.

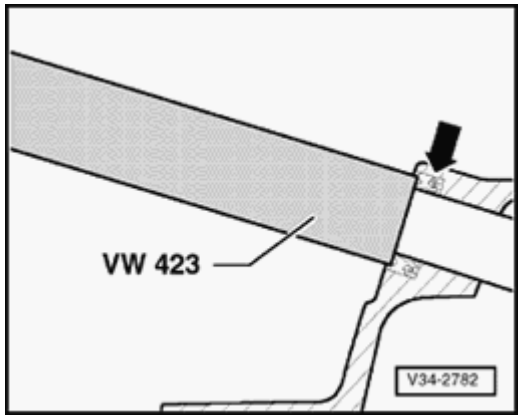


Fig. 9 Driving in seal for selector shaft

- Selector shaft installed or removed

- Fill space between sealing lip and dust lip with sealing grease G52 128 A1.
- Pull assembly sleeve onto selector shaft ⇒ Fig. 10 .
- Drive seal into housing onto stop.

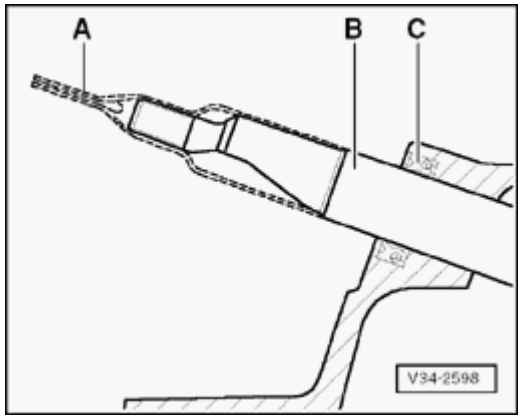


Fig. 10 Installing seal and selector shaft with assembly sleeve

- To avoid damaging seal -C- always use assembly sleeve -A-, Part No. 01E 311 120, to install seal or selector shaft.

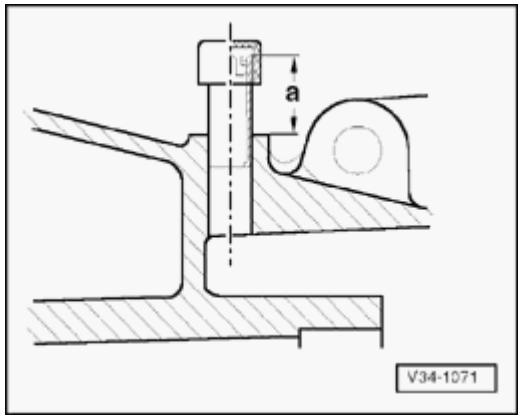


Fig. 11 Insertion depth of breather sleeve for transmissions without breather hose

- Dimension a = 21 mm

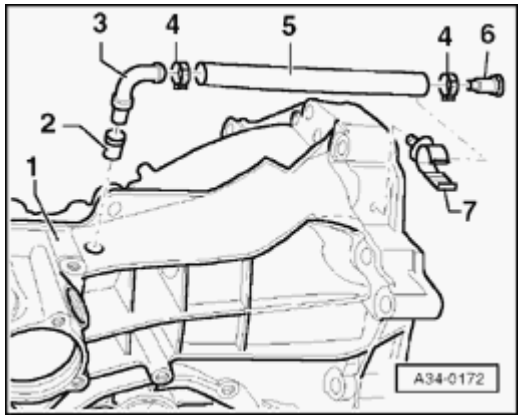


Fig. 12 Breather for transmission with breather hose

1 - Transmission

2 - Sleeve: drive in onto stop

3 - Pipe: drive in onto stop

4 - Clamp

5 - Hose

6 - Breather pipe

7 - Retaining clip

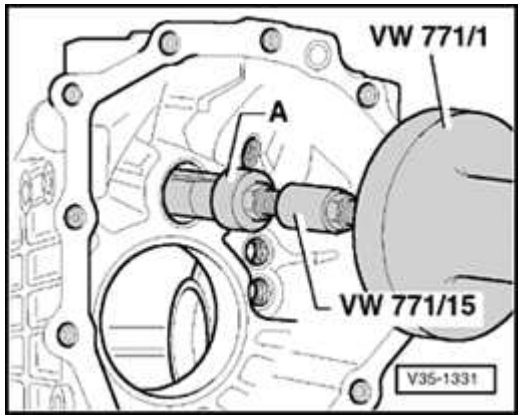


Fig. 13 Pulling needle bearing out of transmission housing

A - Internal puller 30-37 mm, e.g. Kukko 21/5

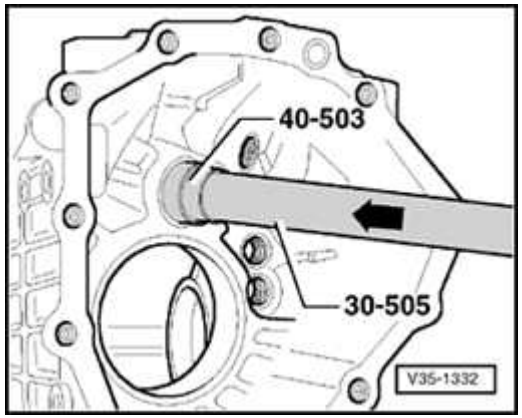


Fig. 14 Driving needle bearing into transmission housing

- Installation position: inscription on bearing faces tool
- Insertion depth ⇒ Fig. 15

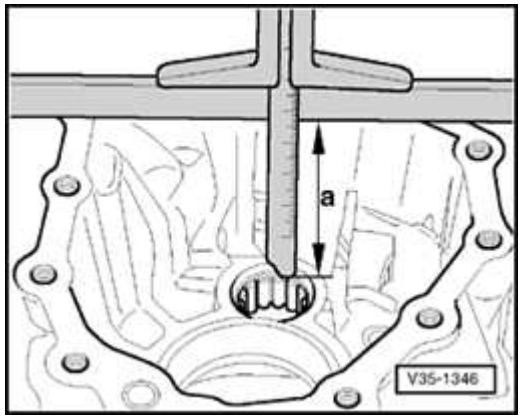


Fig. 15 Insertion depth of needle bearing

Dimension a = 105 mm

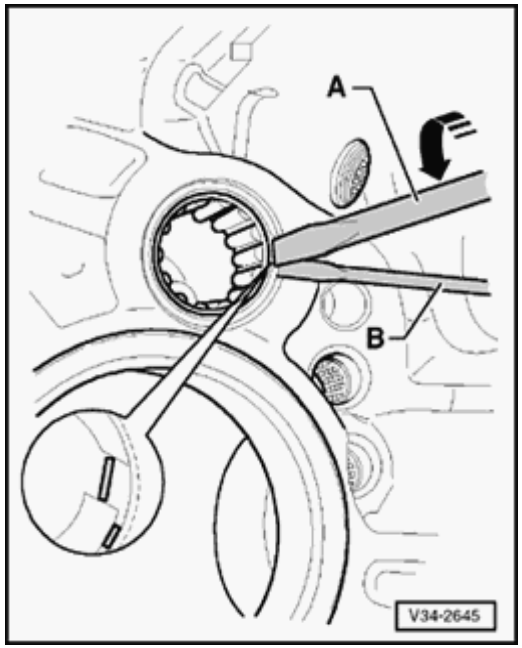


Fig. 16 Removing circlip

- Lift circlip out of groove by turning one end of circlip with a screwdriver -A-.
- Secure this end with a screwdriver -B-.
- Pry circlip out further by repositioning screwdriver -A-.

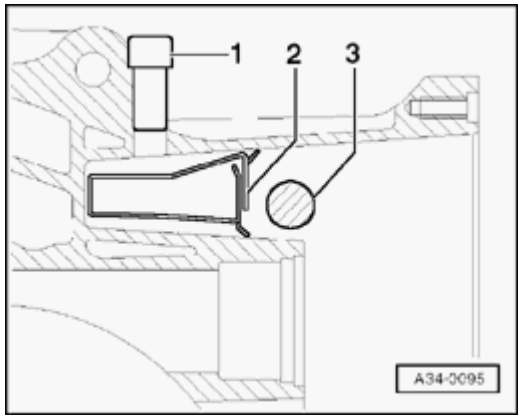


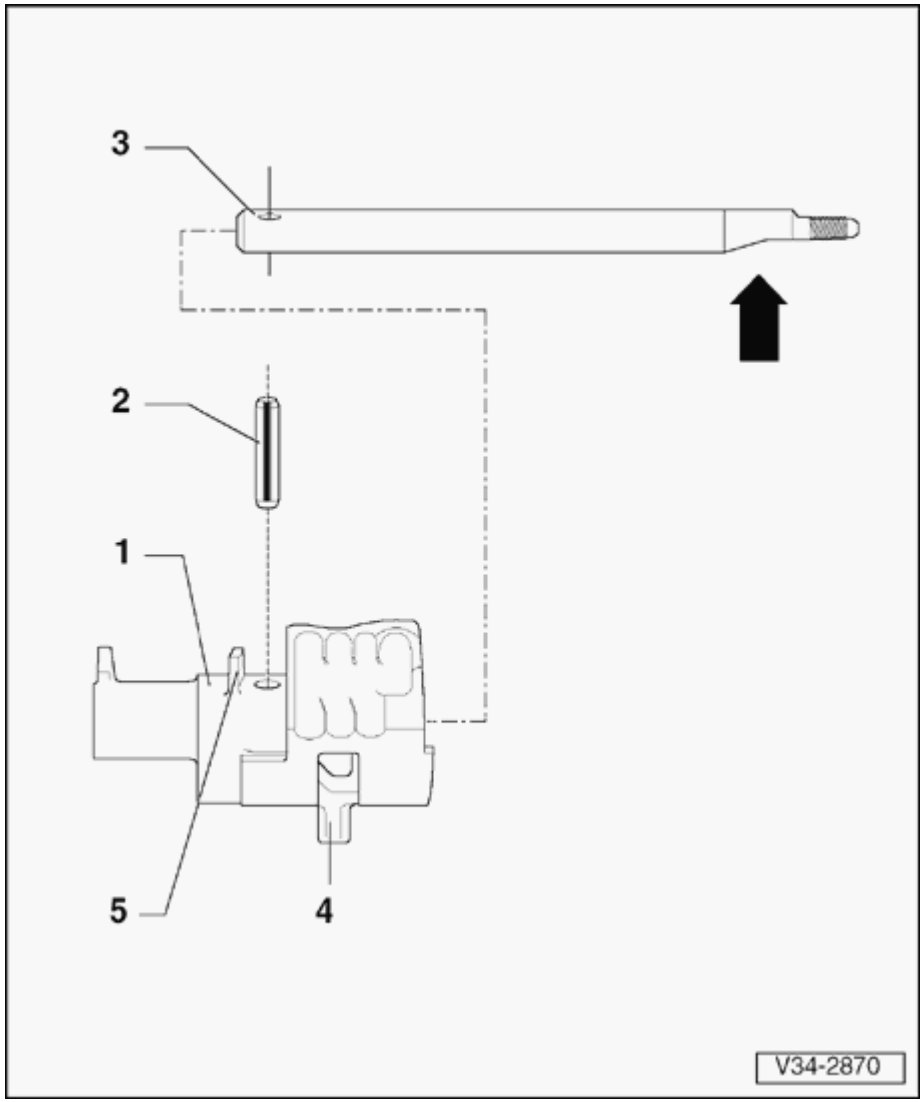
Fig. 17 Installation position of oil baffle plate for transmission DSY

1 - Breather

2 - Oil baffle plate

3 - Selector shaft

34-144



Selector shaft (complete), disassembling and assembling

1 - Selector cylinder

2 - Roll pin

- Drive out and drive in flush ⇒ Fig. 1

3 - Selector shaft

- Driving out ⇒ Fig. 2
- Driving in ⇒ Fig. 3
- Installation position: flat (arrow) and selector finger - 4 - face in same direction

4 - Selector finger

- Observe installation position to - 3 -

5 - Cam for reversing light switch

34-145

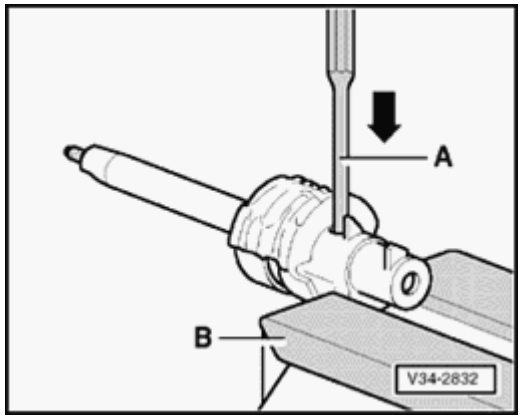


Fig. 1 Driving out and driving in roll pin flush

A - Drift

B - Vice clamps

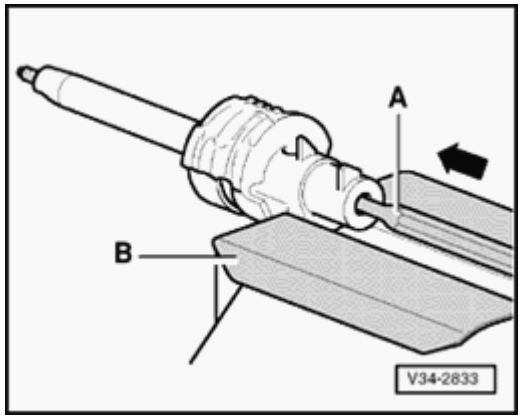


Fig. 2 Driving out selector shaft

A - Drift

B - Vice clamps

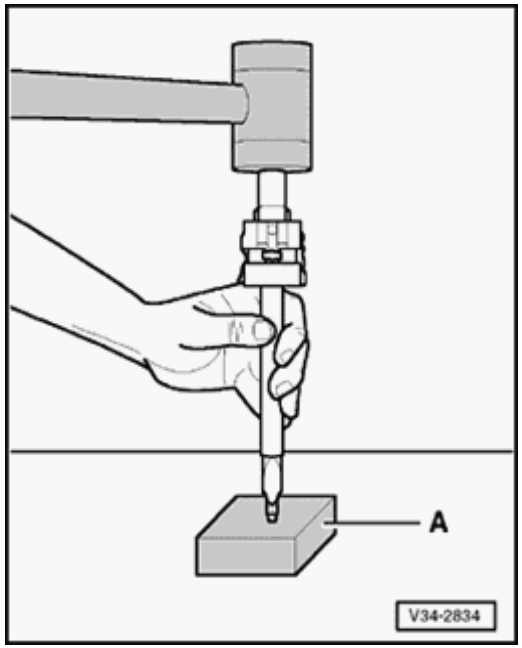


Fig. 3 Driving in selector shaft

A - Wooden block

Note:

- *Bring holes into alignment.*
- *Flat on selector shaft and selector finger point in same direction.*

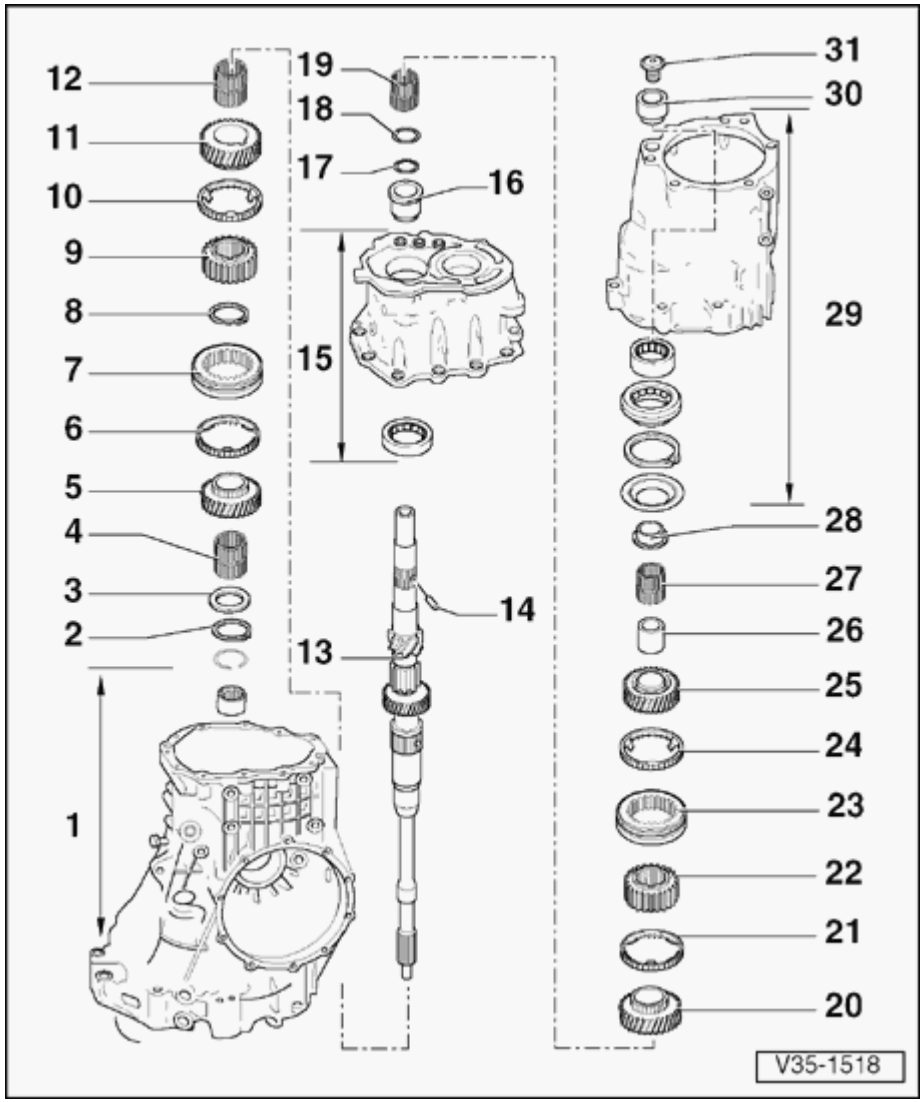
35-1

Input shaft, disassembling and assembling

Special tools, testers and auxiliary items required:

- Thrust plate VW 401
- Press tool VW 412
- Tube VW 519
- Feeler gauge

35-2



Note:

When installing new gears ⇒ Page 00-3 , Technical data

1 - Gearbox housing

- Servicing ⇒ Page 34-127

2 - Circlip

3 - Thrust washer

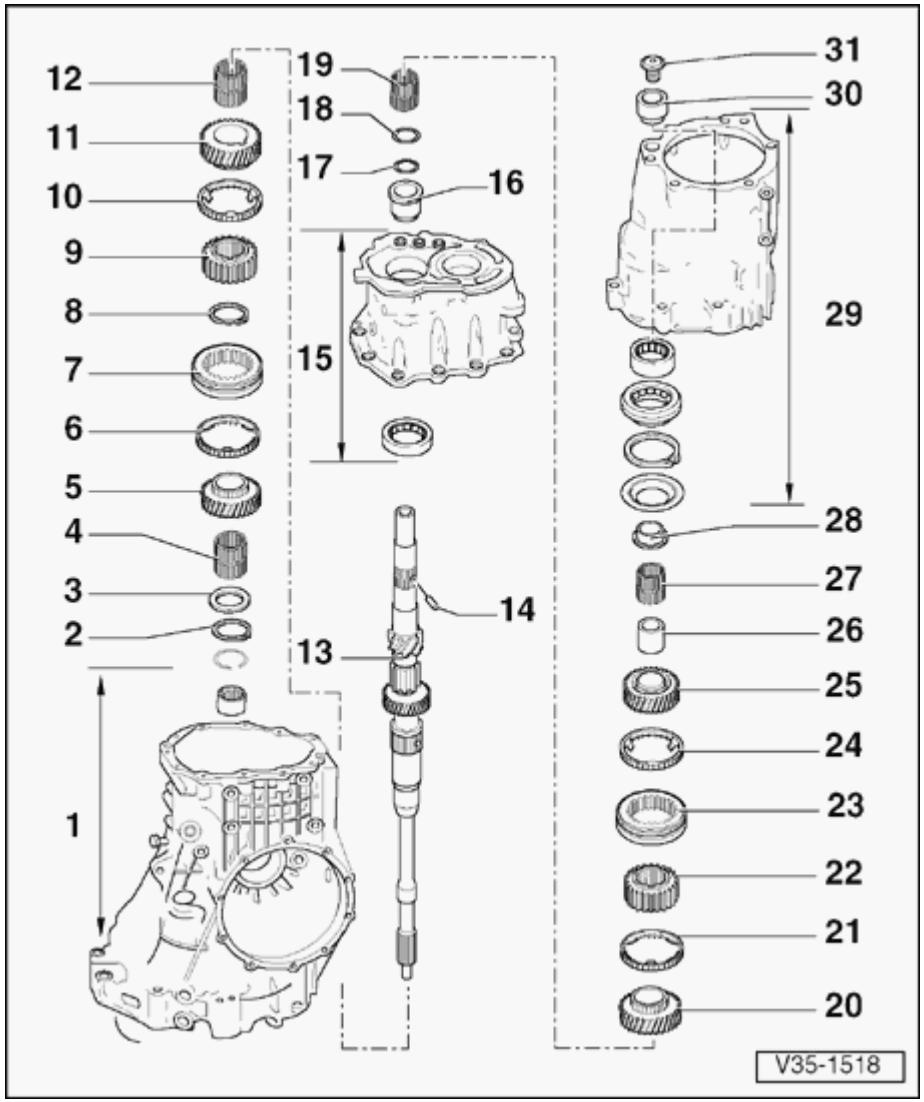
4 - Needle bearing for 4th gear

- Mark before removing
- Do not interchange with needle bearing for 3rd gear
- Oil with gear oil before installing

5 - 4th speed sliding gear

- Before installing, insert spring ⇒ Fig. 1
- After installing, check axial clearance with a feeler gauge (0.15-0.35 mm)

35-3



6 - Synchro-ring for 4th gear

- Check for wear ⇒ Fig. 2

7 - Locking collar

- Paired with synchro-hub
- Mark before removing ⇒ Page 34-63

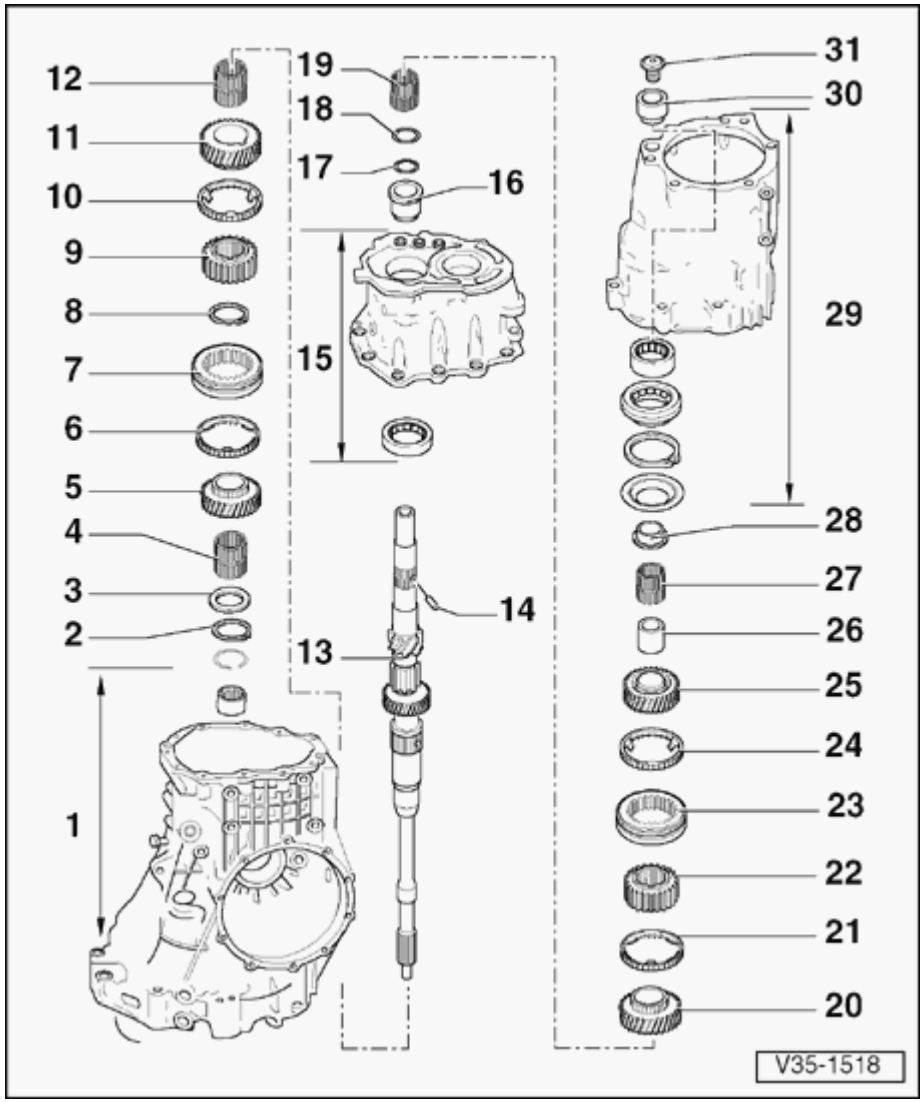
8 - Circlip

- Re-determine thickness when replacing synchro-hub ⇒ Fig. 3
- Installation position: ends align with groove of synchro-hub

9 - Synchro-hub for 3rd and 4th gear

- Pressing off ⇒ Fig. 4
- Installation position ⇒ Fig. 5
- Pressing on ⇒ Fig. 6

35-4



10 - Synchro-ring for 3rd gear

- Coated with molybdenum
- Check for wear ⇒ Fig. 2

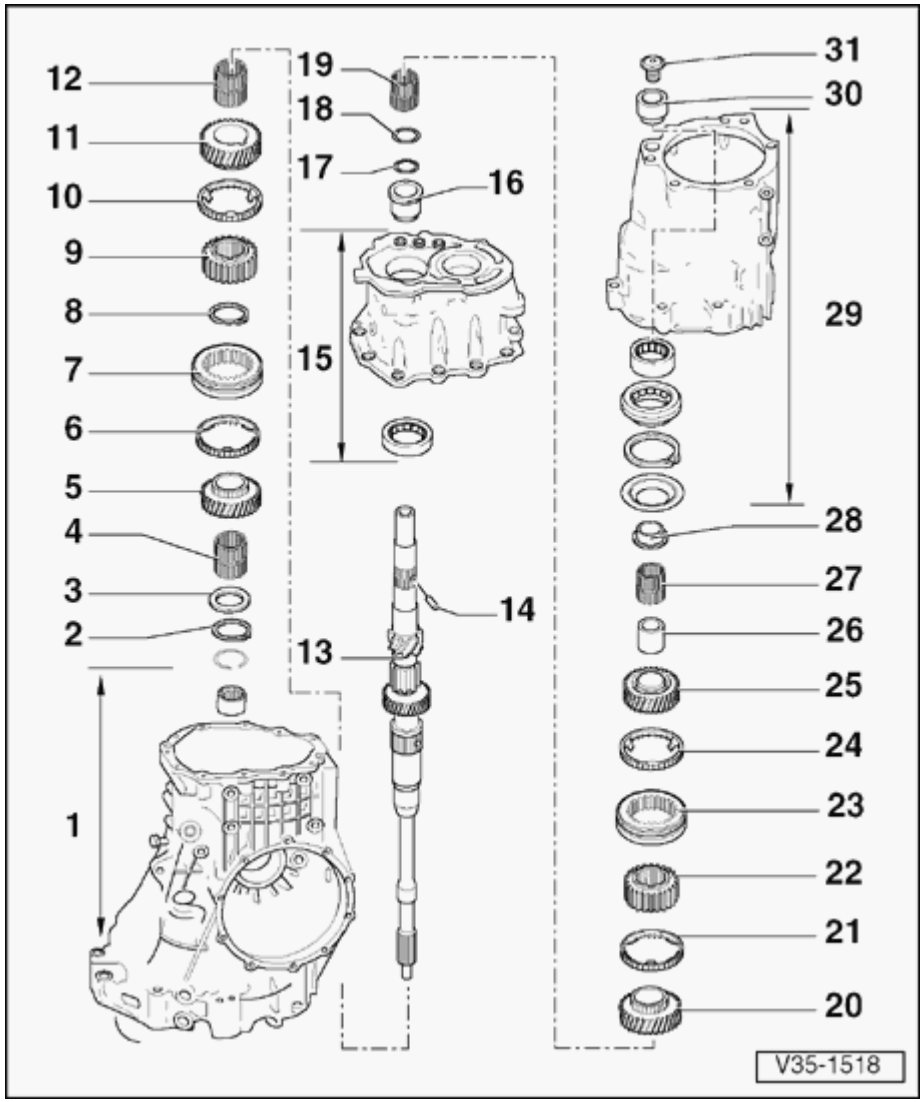
11 - 3rd speed sliding gear

- Before installing, insert spring ⇒ Fig. 1
- After pressing on -item 9 -, check axial clearance with a feeler gauge (0.15-0.35 mm)

12 - Needle bearing for 3rd gear

- Mark before removing
- Do not interchange with needle bearing for 4th gear
- Oil with gear oil before installing

13 - Input shaft



14 - Spring pin

- Drive in when replacing input shaft ⇒ Fig. 7

15 - Bearing plate

- Servicing ⇒ Page 34-112

16 - Inner race for cylinder roller bearing

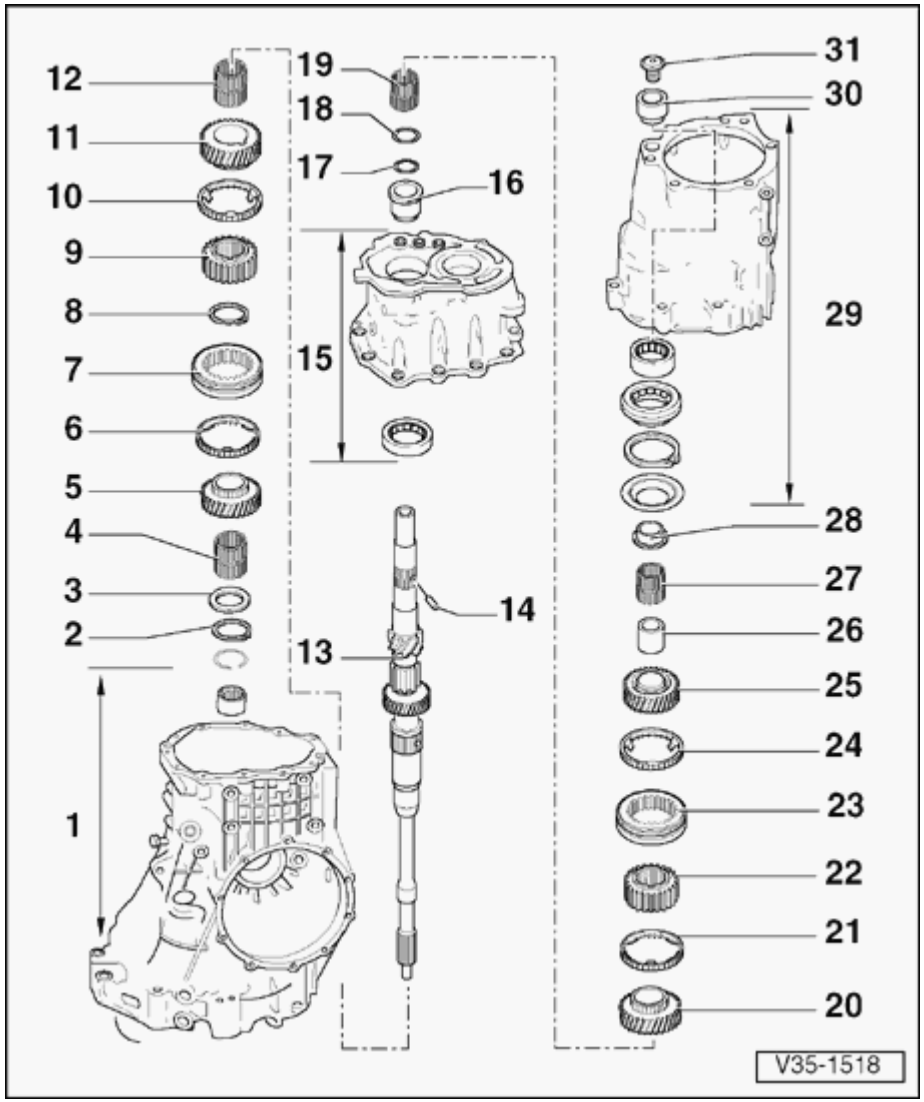
- Take off and fit by hand

17 - Circlip

18 - Thrust washer for needle bearing for 6th gear

- Installation position: shoulder towards circlip, smooth contact surface towards needle bearing ⇒ Page 34-75

35-6



19 - Needle bearing for 6th gear

- Oil with gear oil before installing

20 - 6th speed sliding gear

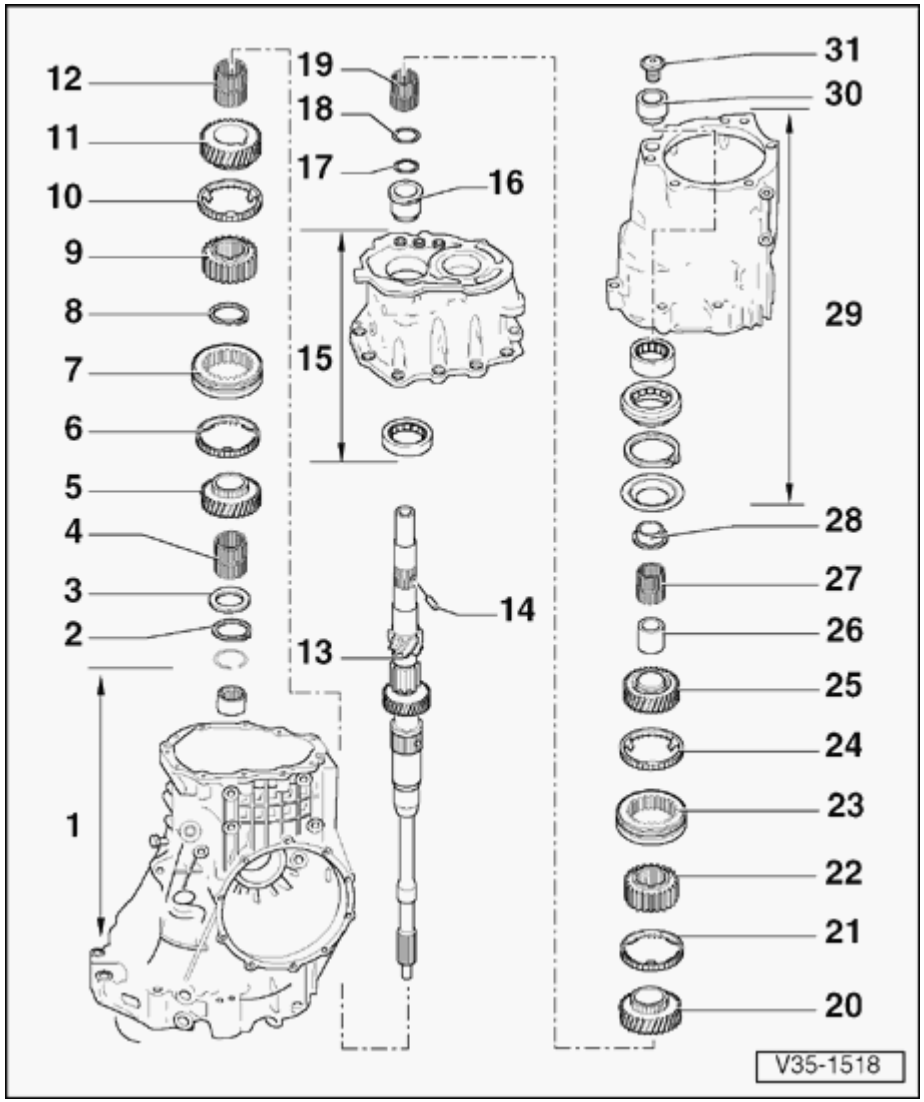
- Before installing, insert spring ⇒ Fig. 1
- After installing, check axial clearance with a feeler gauge (0.15-0.35 mm)

21 - Synchro-ring for 6th gear

- Check for wear ⇒ Fig. 2

22 - Synchro-hub for 5th and 6th gear

- Pulling off ⇒ Page 34-64
- Driving on ⇒ Page 34-76
- Installation position: projecting hub towards 5th speed sliding gear



23 - Locking collar

- Paired with synchro-hub
- Mark before removing ⇒ Page 34-63

24 - Synchro-ring for 5th gear

- Checking for wear ⇒ Fig. 2

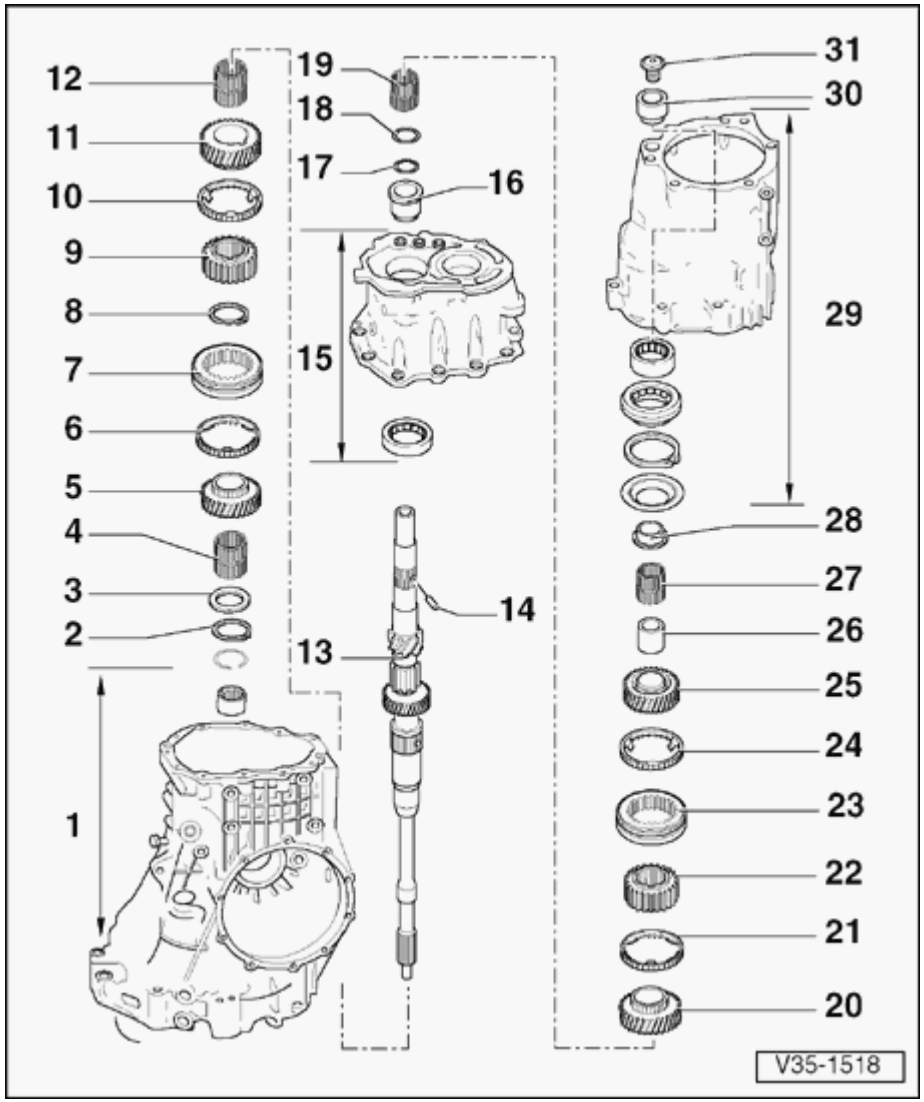
25 - 5th speed sliding gear

- Before installing, insert spring ⇒ Fig. 1
- After installing, check axial clearance ⇒ Page 34-81

26 - Inner race for 5th speed sliding gear

- Pulling off ⇒ Page 34-64
- Driving on ⇒ Page 34-81

35-8



27 - Needle bearing for 5th gear

- Oil with gear oil before installing

28 - 1st inner race for tapered roller bearing for input shaft

- Pulling off ⇒ Page 34-61
- Driving on ⇒ Page 34-81

29 - End cover

- Servicing ⇒ Page 34-103

30 - 2nd inner race for tapered roller bearing for input shaft

- Pulling off ⇒ Page 34-61
- Driving on ⇒ Page 34-82

31 - Multi-point socket head bolt, 150 Nm

- Loosening and tightening ⇒ Page 34-60

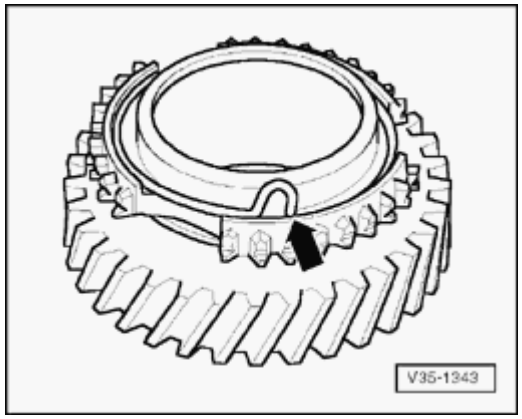


Fig. 1 Inserting spring in sliding gear

- Insert spring (arrow) in sliding gear, hook angled end into hole.

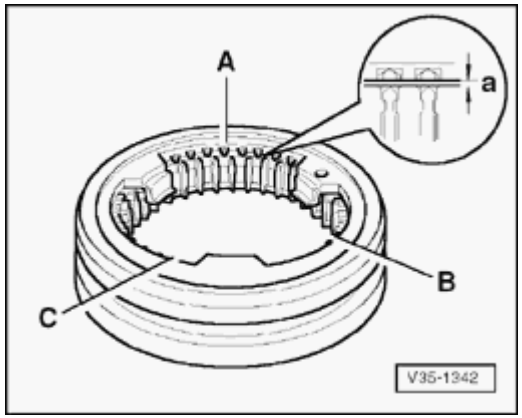


Fig. 2 Checking synchro-ring for wear

- Press synchro-ring into locking collar and measure gap "a" with a feeler gauge at positions -A-, -B- and -C-.
- Add together results and divide by three.
  - ♦ The figure calculated must not be less than 0.5 mm

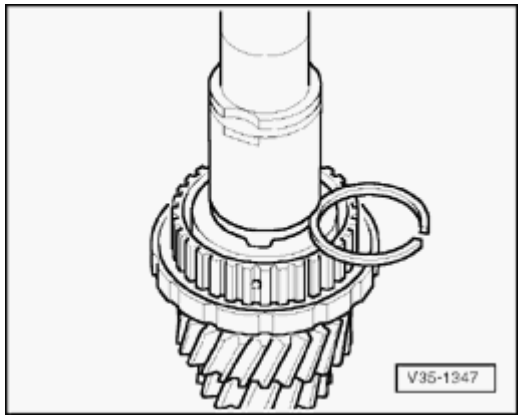


Fig. 3 Re-determining thickness of circlip

- Press synchro-hub onto stop.

Note:

Note installation position when pressing on ⇒ Fig. 5 .

- Determine thickest circlip that can still just be fitted.

Note:

The opening of the circlip must align with the groove in the synchro-hub.

- Determine circlip from table.

⇒ *Parts catalog*

Circlips available

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Fit circlip.

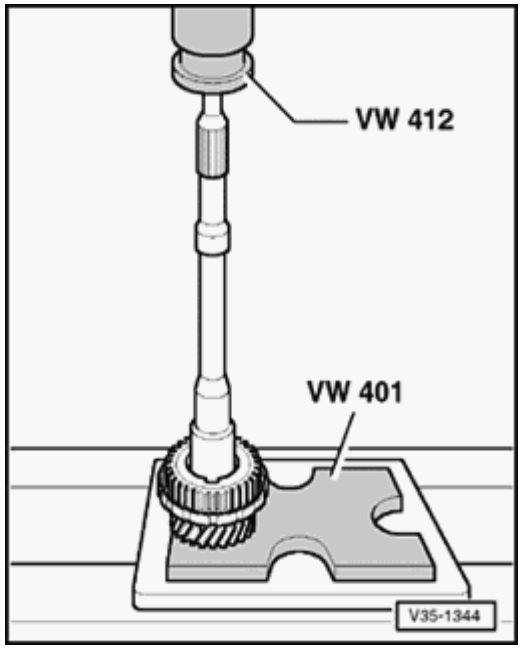


Fig. 4 Pressing off synchro-hub for 3rd and 4th gear

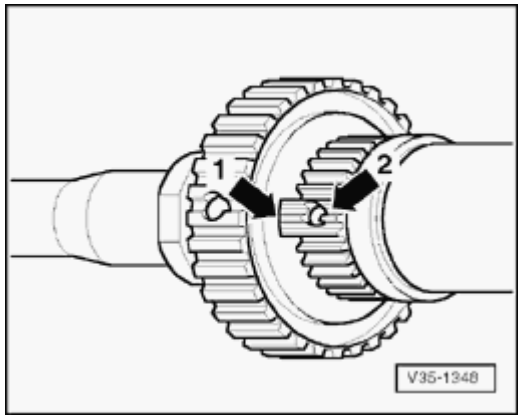


Fig. 5 Synchro-hub installation position

- Oil groove in synchro hub (arrow -1-) must align with oil drilling -arrow 2- in input shaft

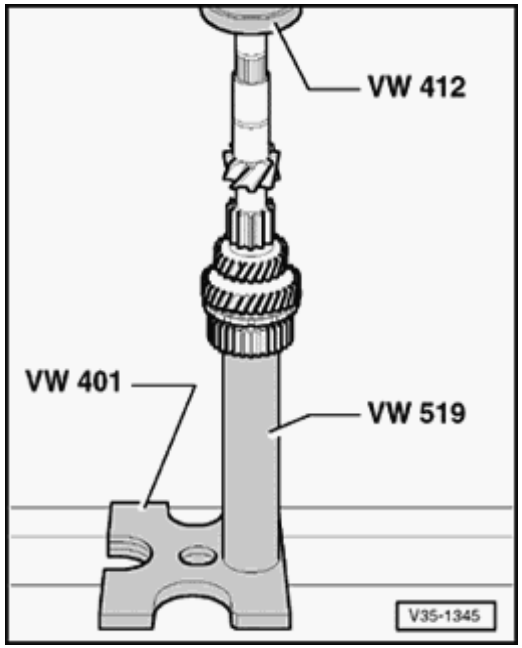


Fig. 6 Pressing on synchro-hub for 3rd and 4th gear

- Heat synchro-hub to approx. 100 ° C, fit and press home.
- Fit circlip.

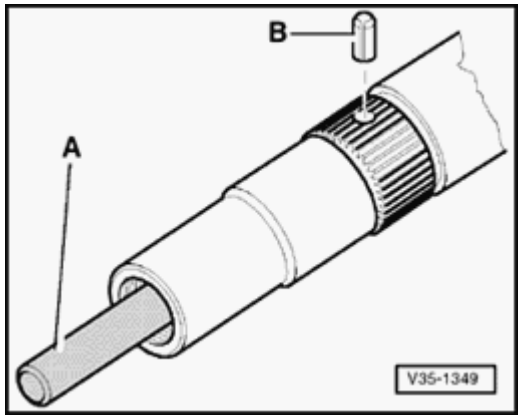


Fig. 7 Driving spring pin into input shaft

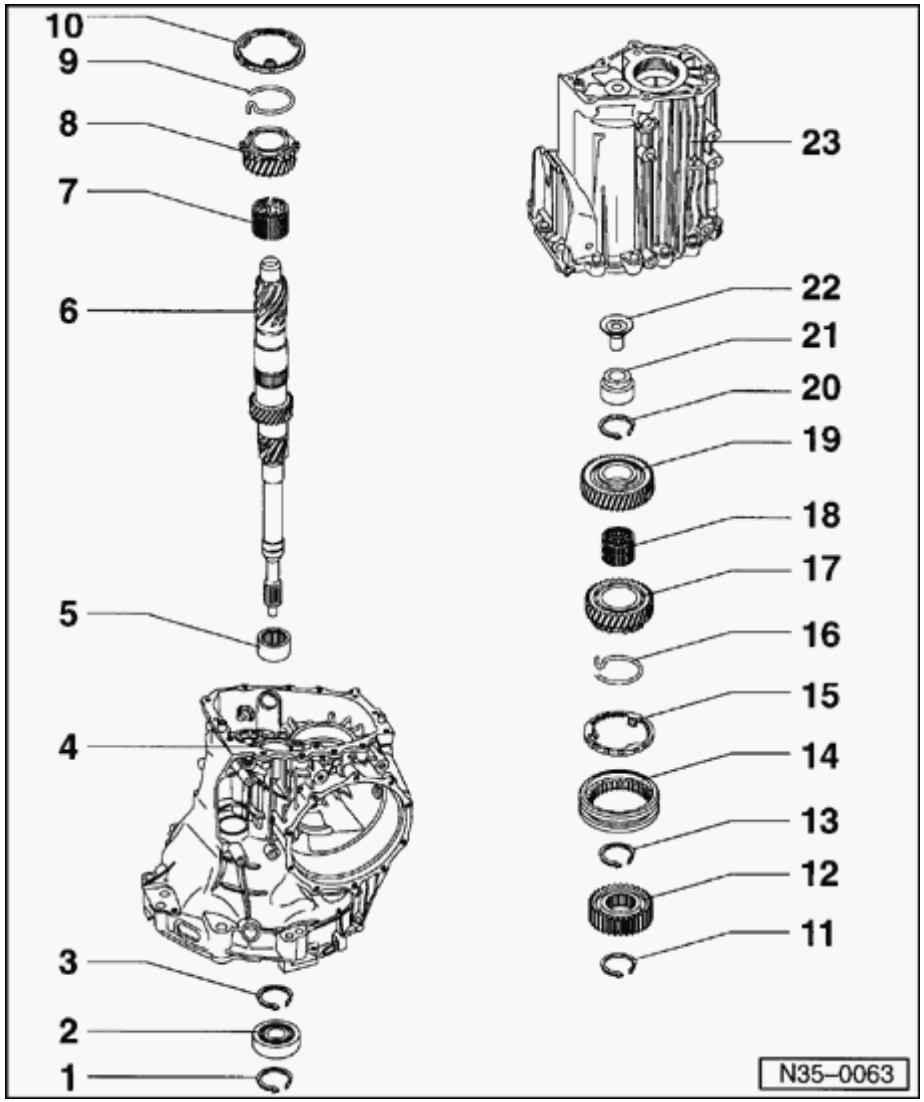
- Guide a 9 mm diameter drift -A- into oil drilling and drive spring pin -B- in until it touches drift.

Input shaft, disassembling and assembling

Special tools and equipment

- VW222A pilot drift
- VW295 needle bearing drift
- VW295A needle bearing drift
- VW401 thrust plate and VW402 thrust plate
- VW407 punch and VW408A punch
- VW415A tube and 416B tube
- VW447I thrust pad
- VW771 slide hammer-complete set
- 30-24 drift
- 30-100 press tube

- 40-105 thrust piece
- 40-202 press-out piece
- Kukko 17/2 separating tool
- Kukko 21/4 extractor



Notes:

- *When installing the input shaft or new gears, consult technical data ⇒ Page 00-3 .*
- *By exchanging parts (Figs. 2, 4 and 6), the position of the ball bearing is influenced. In this case the input shaft must be re-adjusted ⇒ Page 35-17 .*

1 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -1-
- Determining thickness ⇒ Page 35-17 , input shaft, adjusting

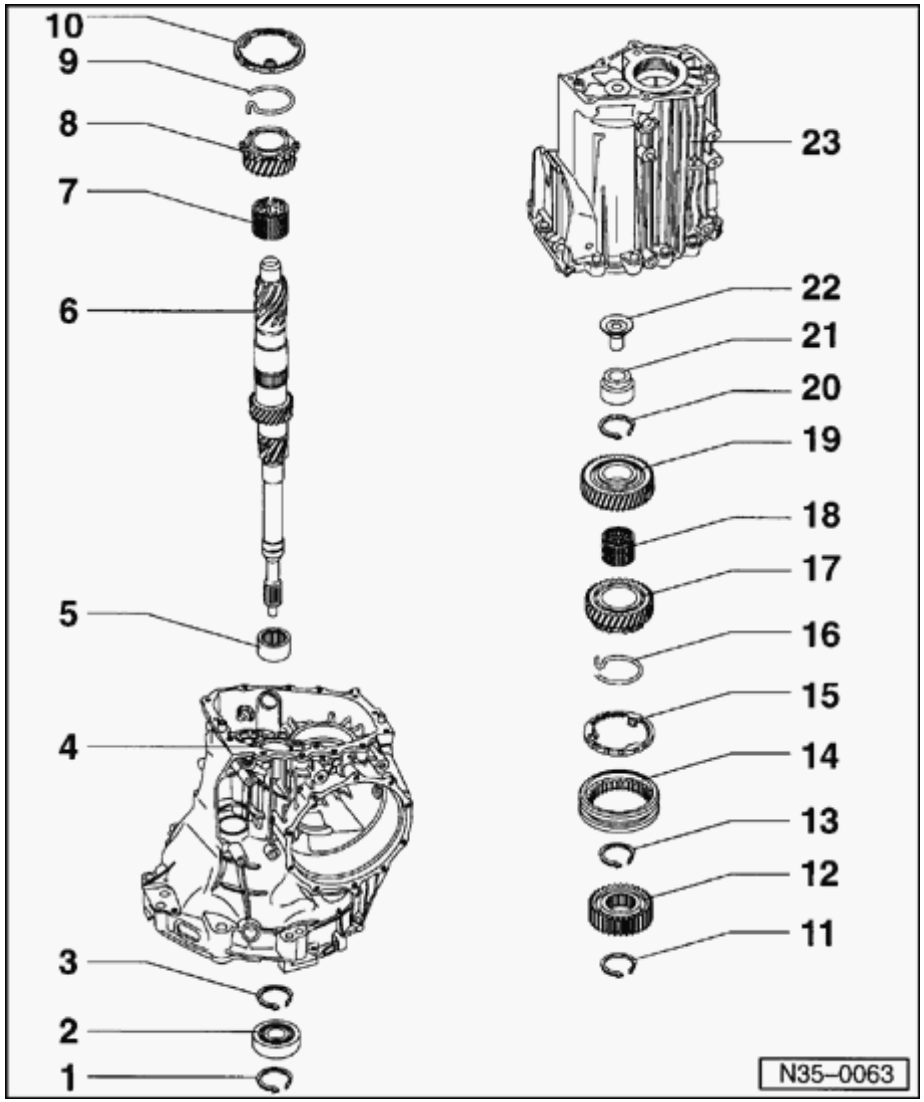
2 - Ball bearing for input shaft

- Removing and installing ⇒ Page 34-55

3 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -2-
- Determining thickness ⇒ Page 35-17 , input shaft, adjusting

4 - Transmission housing



5 - Needle bearing for input shaft

- Secured with bolt ⇒ Fig. 1
- Driving out ⇒ Fig. 2
- Application of input shaft/needle bearing ⇒ Fig. 3
- Allocation ⇒ Fig. 4
- Pressing in ⇒ Fig. 5

6 - Input shaft

- With oiling sleeve
- Driving in oiling sleeve ⇒ Fig. 6
- Application of input shaft/needle bearing ⇒ Fig. 3
- Adjusting ⇒ Page 35-17

7 - Needle bearing for 3rd gear

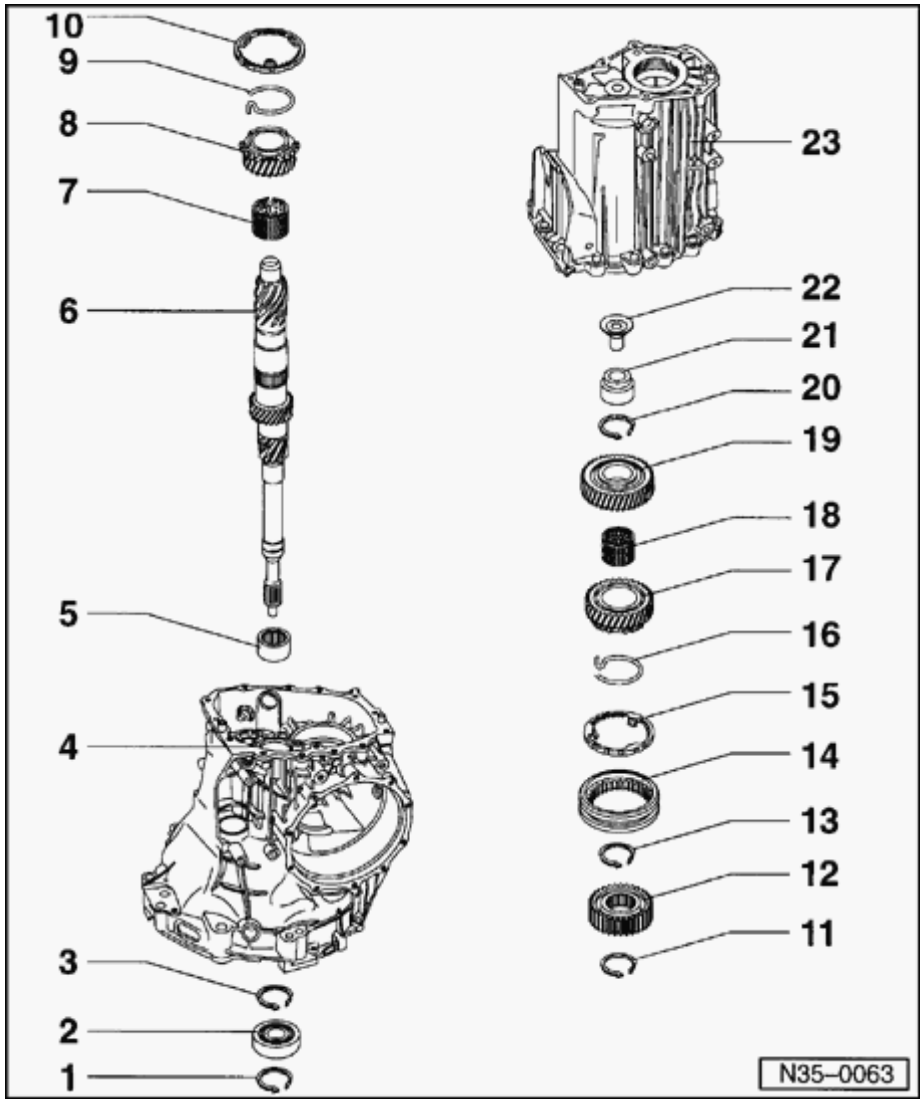
8 - 3rd gear

9 - Spring

- Inserting in 3rd gear ⇒ Fig. 12
- Application of spring to gear ⇒ Parts catalog

10 - Synchronizer ring for 3rd gear

- Checking for wear ⇒ Fig. 13



11 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -3-

12 - Synchronizer hub for 3rd and 4th gears

- Shoulder faces 3rd gear
- Pressing off ⇒ Fig. 11
- Pressing on ⇒ Fig. 16

13 - Circlip

- Identification
- Allocation ⇒ Fig. 14 , item -4-
- Re-determining thickness when replacing synchronizer body ⇒ Fig. 13

14 - Operating sleeve for 3rd and 4th gears

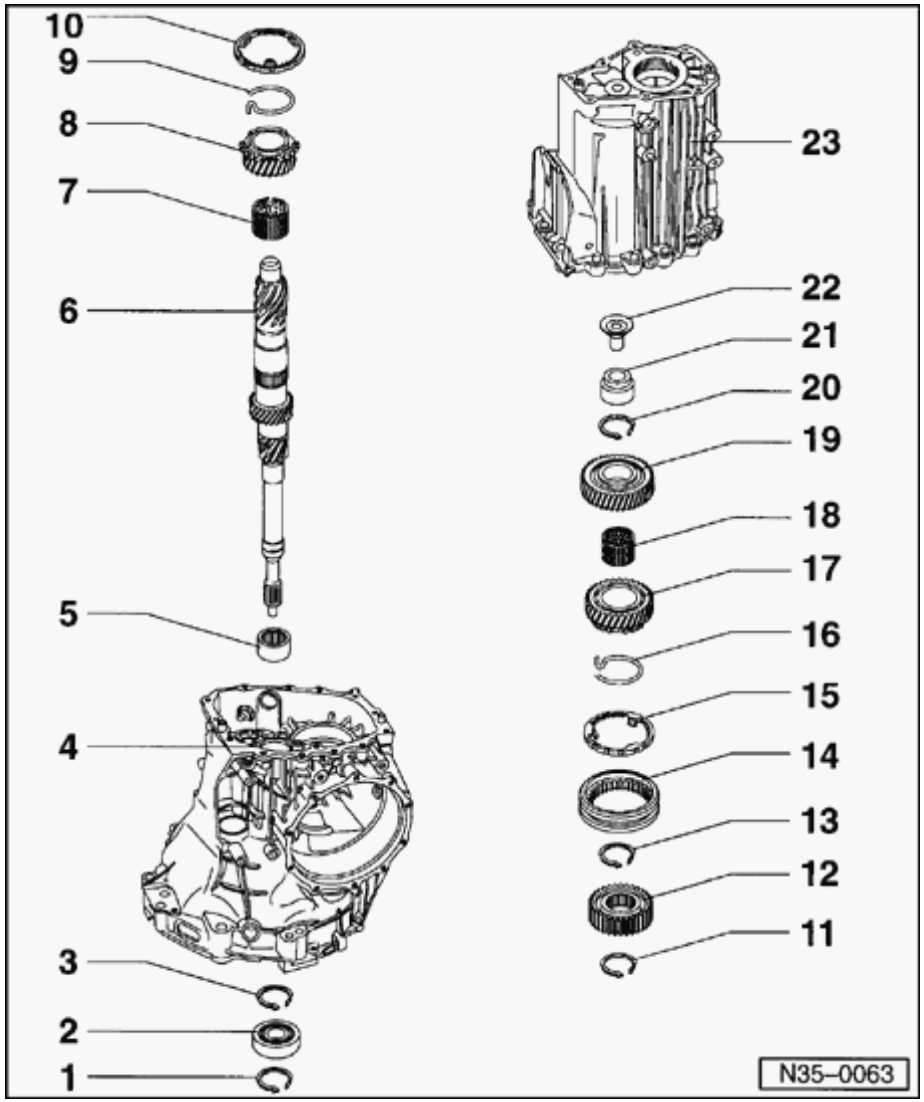
- Allocation ⇒ Fig. 17

15 - Synchronizer ring for 4th gear

- Checking for wear ⇒ Fig. 13

16 - Spring

- Inserting in 4th gear ⇒ Fig. 12
- Application of spring to gear ⇒ Parts catalog



17 - 4th gear

18 - Needle bearing for 4th gear

19 - 5th gear

- Pressing off ⇒ Fig. 10
- Pressing on ⇒ Fig. 18

20 - Circlip

- Identification
- Allocation ⇒ Fig. 14 item -5-
- If 5th gear is replaced, re-determine thickness of circlip ⇒ Fig. 15

21 - Needle bearing for input shaft

- Always replace
- Damaged when removed
- Pulling out ⇒ Fig. 7
- Allocation ⇒ Fig. 8
- Driving in ⇒ Fig. 9

22 - Plastic sleeve

- Made of plastic

23 - Transmission cover

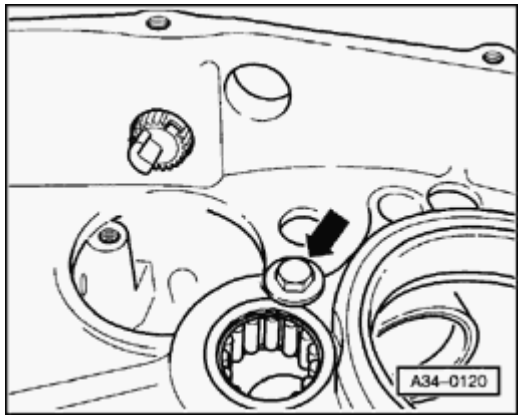


Fig. 1 Securing bolt for needle bearing

- Remove securing bolt (arrow).

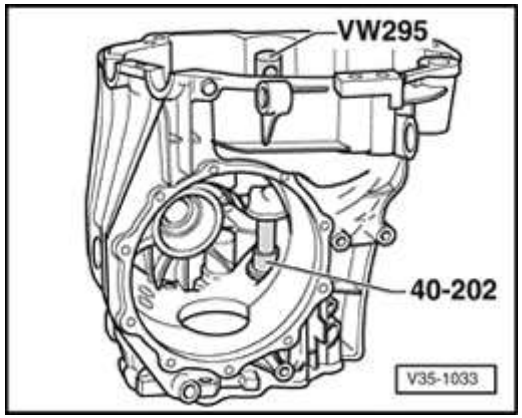


Fig. 2 Driving out needle bearing

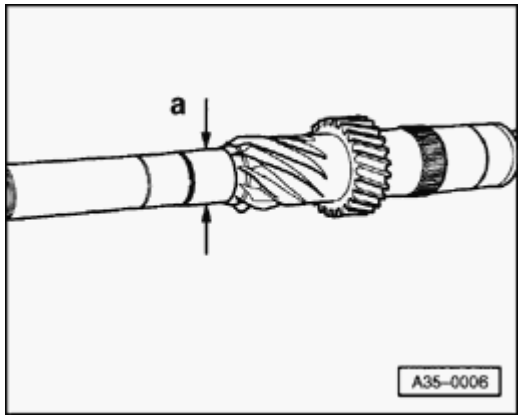


Fig. 3 Allocation of input shaft/needle bearing

Input shaft diameter	
a: 27 mm (1.062 in.)	012 311 123 D
a: 29 mm (1.141 in)	012 311 123

CAUTION!

Part numbers are listed here for reference only. Always check with your Parts department for the latest information.

In order to avoid damage due to improper assembly, check the following after replacing input shaft:

- ***Input shaft must be able to be guided in.***
- ***Input shaft must have no play.***

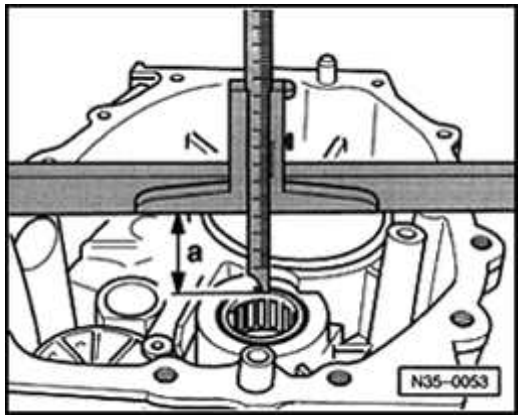


Fig. 4 Allocation of needle bearing

Dimension -a- from lower edge of straight-edge to upper edge of needle bearing: 39.5 mm (1.555 in.)

Note:

Measure the dimension from the top edge of the straight-edge and subtract the height of the straight-edge from the measured dimension.

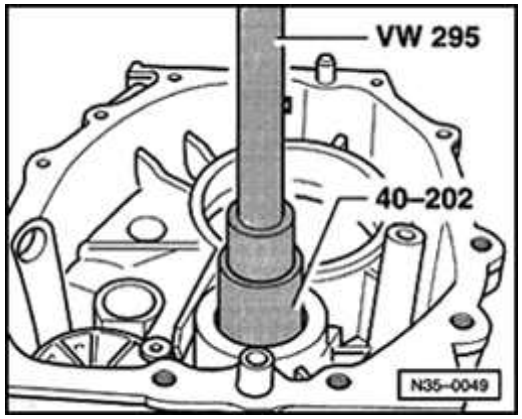


Fig. 5 Pressing in needle bearing

- Install securing bolt and tighten to 25 Nm (18 ft lb).

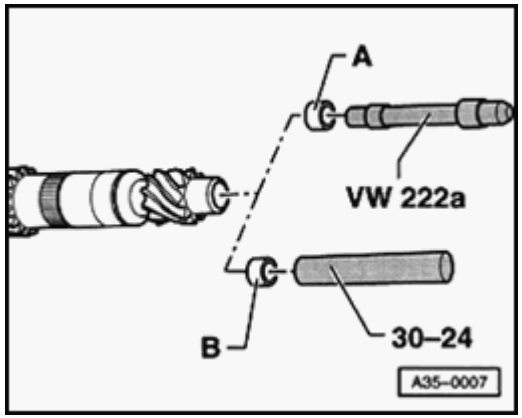


Fig. 6 Driving in oiling sleeve into input shaft

Item	Dia. of oiling sleeve	Tool
A	14 mm (0.551 in.)	VW222A pilot drift
B	16 mm (0.629 in.)	30-24 drift

Installed position

- Flared edge of oiling sleeve faces installation tool
- Allocation: 3.5 mm (0.138 in.) below upper edge

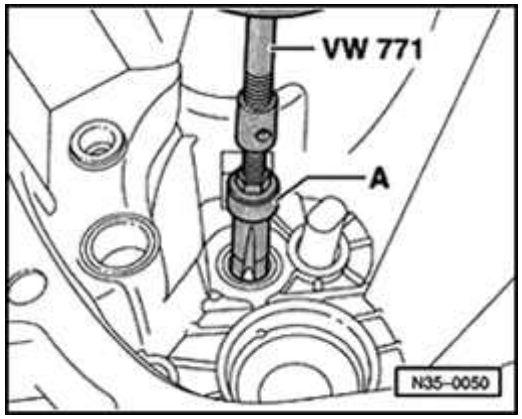


Fig. 7 Pulling out needle bearing

A - Internal puller 22-28 mm (0.866-1.102 in.), e.g. Kukko 21/4 extractor

- Plastic sleeve inside roller sleeve must be destroyed to install internal puller.

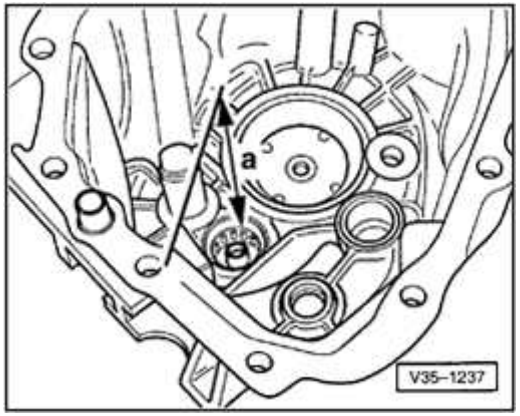


Fig. 8 Allocation of needle bearing

Dimension a: 216 mm (8.503 in.)

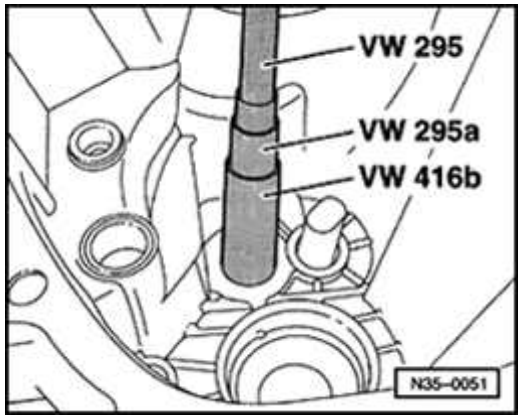


Fig. 9 Driving in roller sleeve

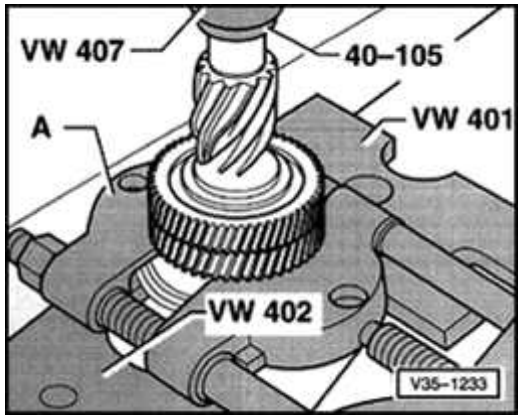


Fig. 10 Pressing off 5th gear

- Remove circlip before pressing off.

A- Separating device 22-115 mm (0.866-4.527 in.), e.g. Kukko 17/2 separating tool

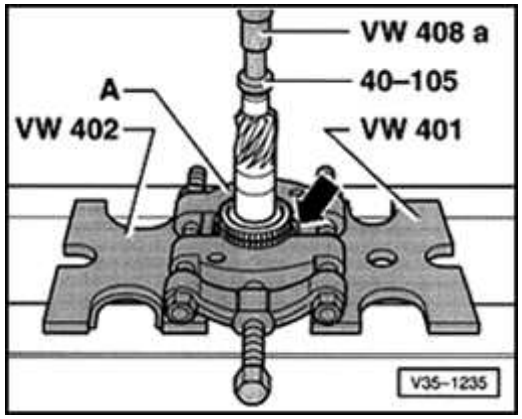


Fig. 11 Pressing off synchronizer hub for 3rd and 4th gears

- Remove circlip before pressing off.
- Press 3rd gear synchronizer ring (arrow) toward 3rd gear and install separating device -A-.

A- Separating device 22-115 mm (0.866-4.527 in.), e.g. Kukko 17/2 separating tool

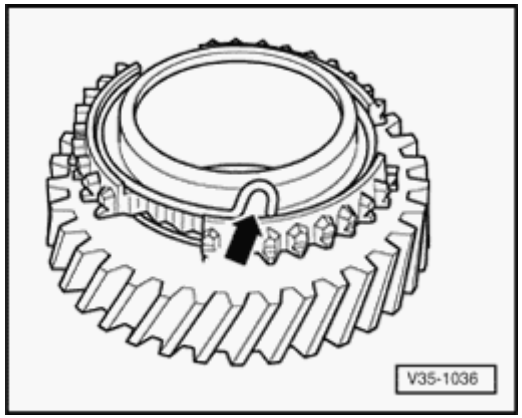


Fig. 12 Inserting spring in gear

The bent end of the spring (arrow) must be hooked into the hole of the gear.

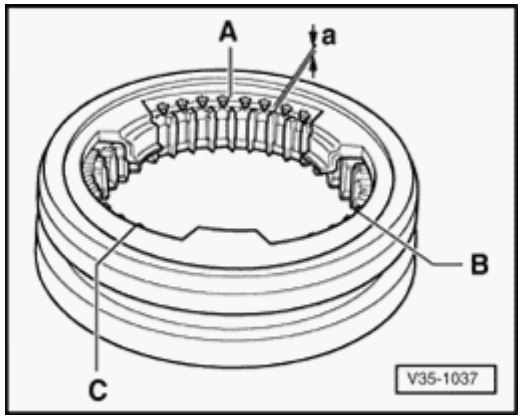


Fig. 13 Checking synchronizer-ring for wear

- Press synchronizer-ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add measured values and divide by 3 to calculate average.

The calculated gap must not be less than 0.5 mm (0.019 in.).

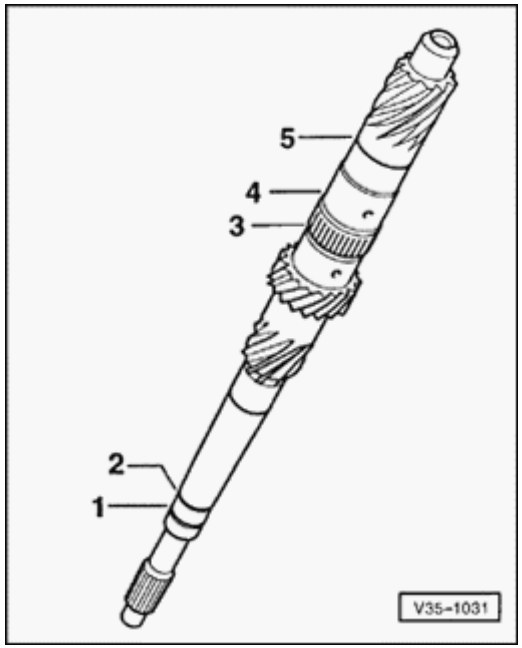


Fig. 14 Allocation of circlips

The circlips -1- and -2- secure the input shaft ball bearing.

Determining thickness ⇒ Page 35-17 , input shaft, adjusting

The circlip -3- secures the 3rd and 4th gear synchronizer hub.

Thickness: 2.00 mm (0.078 in.)

Identification: brown color

The circlip -4- secures the 3rd and 4th gear synchronizer hub.

Determining thickness ⇒ Page 35-14 , table

Identification: blue color

The circlip -5- secures the 5th gear.

Determining thickness ⇒ Page 35-14 , table

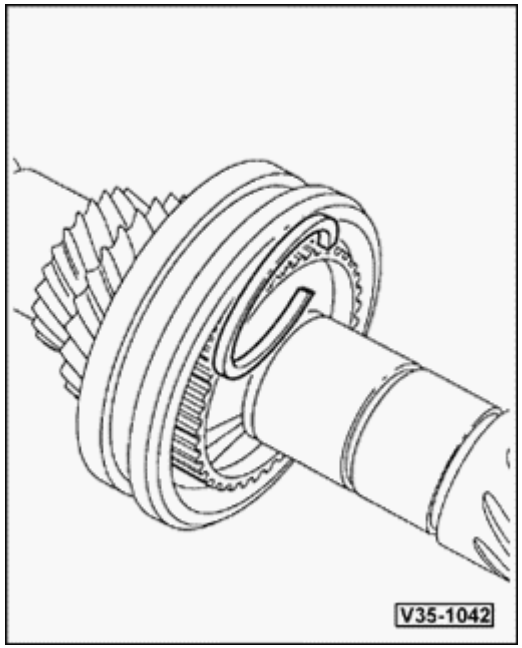


Fig. 15 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Determine circlip according to table. Part number ⇒ parts catalog

The following circlips are available for synchronizer hub for 3rd and 4th gear

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

The following circlips are available for 5th gear

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

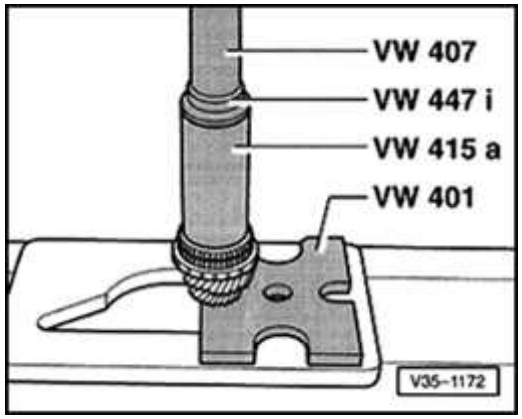


Fig. 16 Pressing on synchronizer hub for 3rd and 4th gears

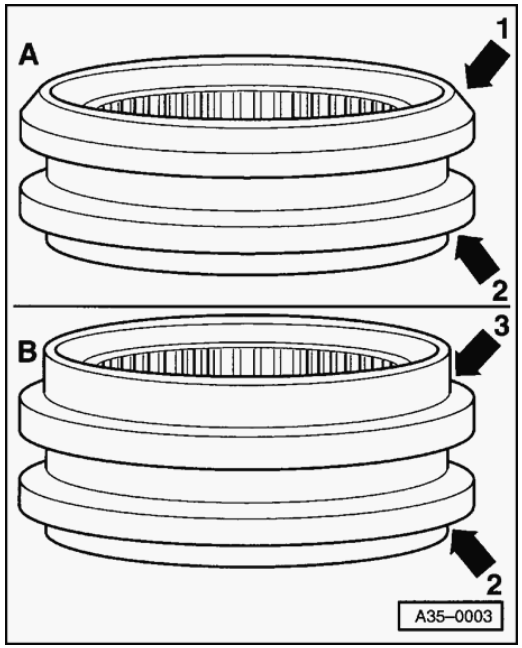


Fig. 17 Allocation of operating sleeve

Operating sleeves with chamfer -A- as well as operating sleeves with a large offset -B- are installed.

Installed position:

- The chamfer (arrow -1-) faces 4th gear
- The small stepped side (arrow -2-) faces 3rd gear
- The large stepped side (arrow -3-) faces 4th gear

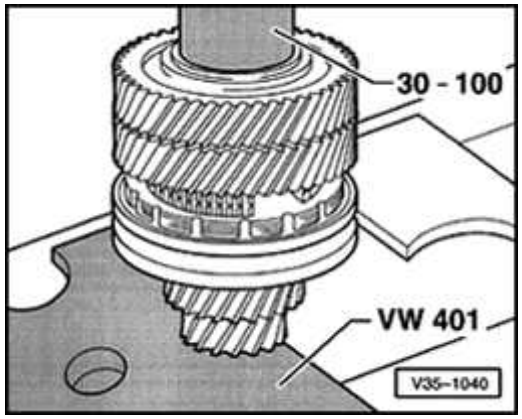


Fig. 18 Pressing on 5th gear

WARNING!

Wear protective gloves.

- Heat 5th gear to approx. 100 ° C (212 ° F) before pressing on.

Allocation: wider collar faces reverse gear.

35-1

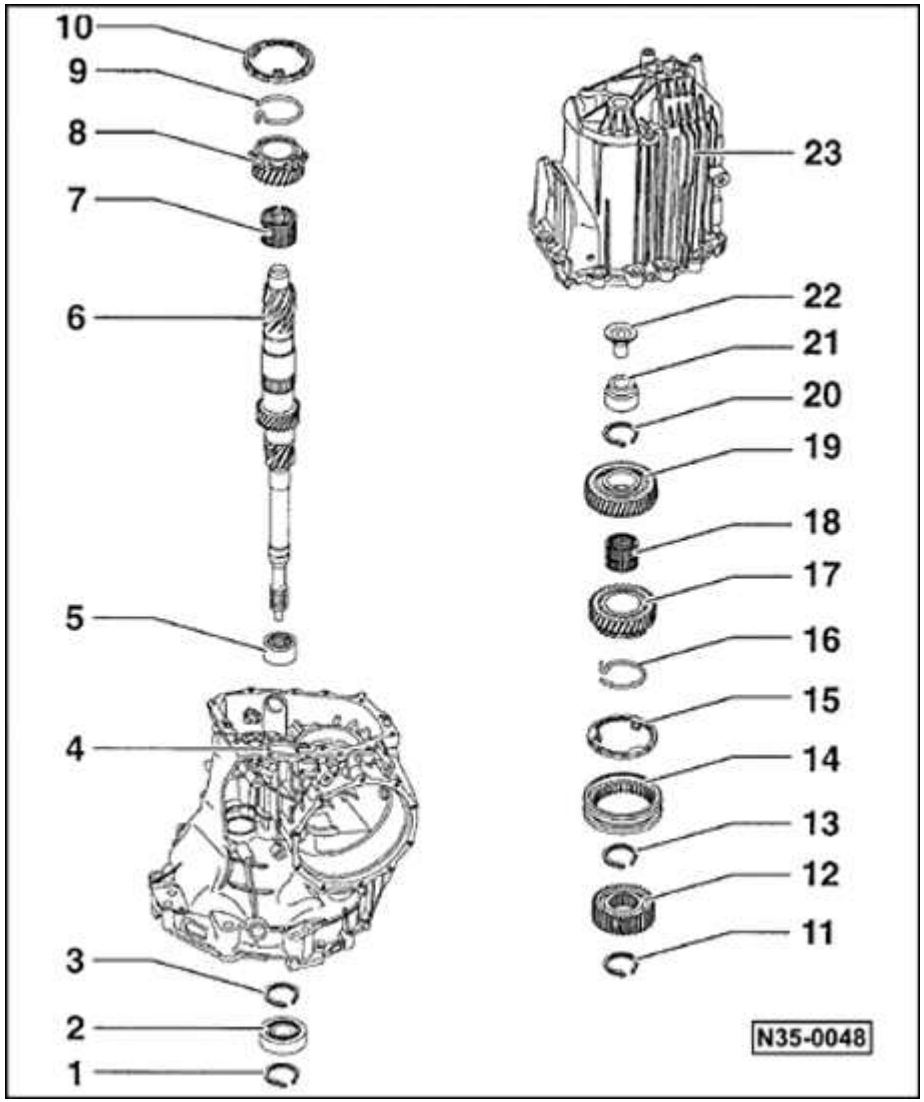
Input shaft, disassembling and assembling

Special tools and equipment

- VW222A pilot drift
- VW295 needle-bearing drift
- VW295A needle-bearing drift
- VW401 thrust plate and VW402 thrust plate
- VW407 punch and VW408A punch
- VW415A tube and VW416B tube
- VW447I thrust pad
- VW771 slide hammer-complete set
- 30-24 drift
- 30-100 press tube

- 40-105 thrust piece
- 40-202 press-out piece
- Kukko 17/2 separating tool
- 21/4 KUKKO extractor

35-2



Notes:

- *When installing the input shaft or new gears, consult technical data ⇒ Page 00-3 .*
- *By replacing items - 2 -, - 4 - and/or - 6 -, the position of the ball bearing is influenced. In this case, the input shaft must be re-adjusted ⇒ Page 35-17 .*

1 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -1-
- Determining thickness ⇒ Page 35-17

2 - Input shaft ball bearing

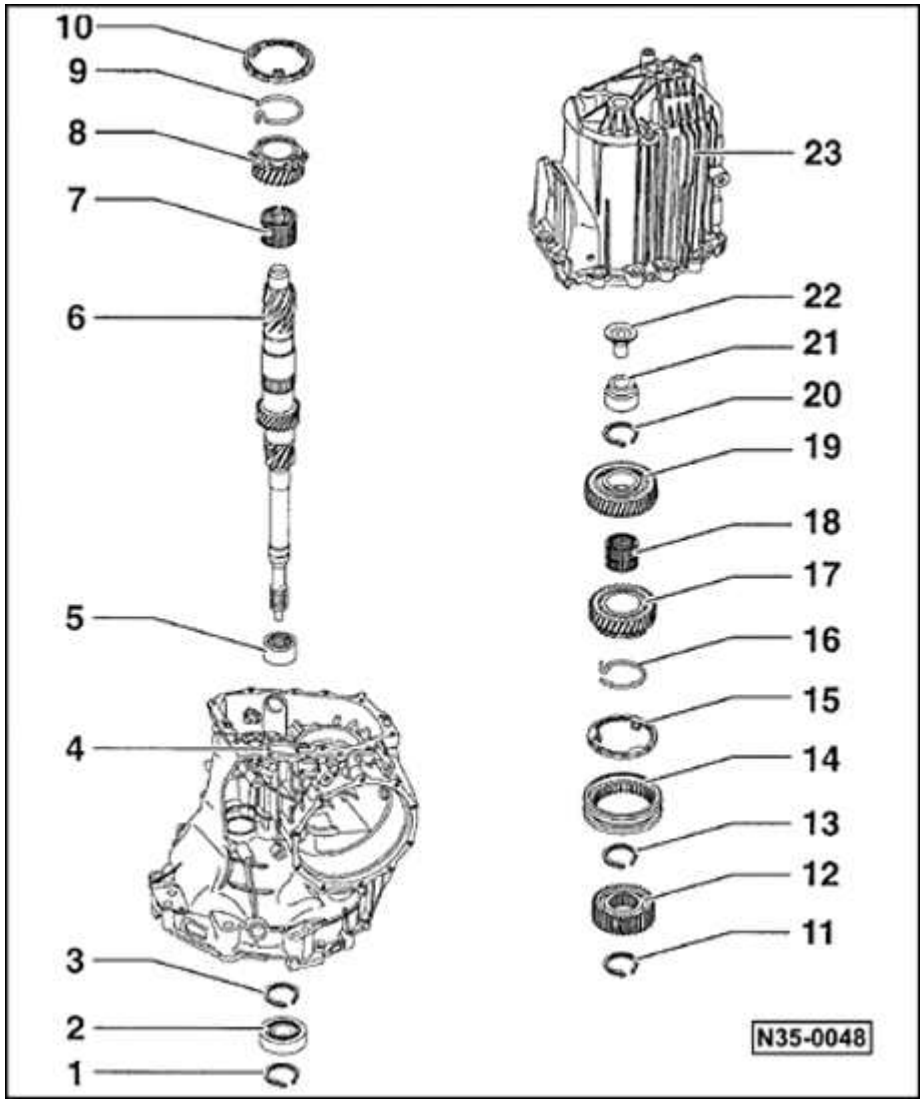
- Removing and installing ⇒ Page 34-49

3 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -2-
- Determining thickness ⇒ Page 35-17

4 - Transmission housing

35-3



5 - Needle bearing

- Secured with bolt ⇒ Fig. 1
- Driving out ⇒ Fig. 2
- Allocation of input shaft/needle bearing ⇒ Fig. 3
- Installed position ⇒ Fig. 4
- Pressing in ⇒ Fig. 5
- Securing ⇒ Fig. 6

6 - Input shaft

- With oiling sleeve
- Driving in oiling sleeve ⇒ Fig. 7
- Adjusting ⇒ Page 35-17
- Allocation of input shaft/needle bearing ⇒ Fig. 3

7 - Needle bearing for for 3rd gear

- Identification

8 - 3rd gear

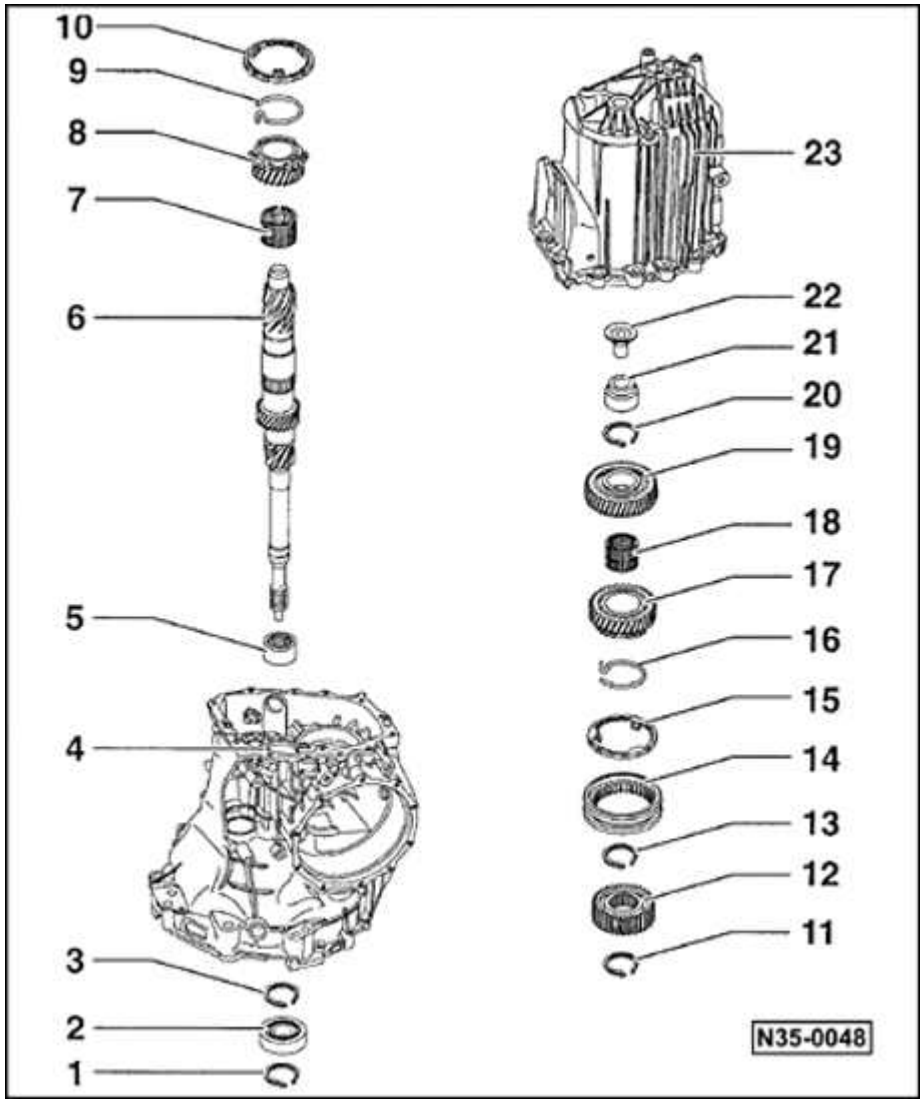
9 - Spring

- Inserting in 3rd gear ⇒ Fig. 13
- Allocation of spring to gear ⇒ parts catalog

10 - Synchronizer ring for 3rd gear

- Checking for wear ⇒ Fig. 14

35-4



11 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -3-

12 - Synchronizer hub for 3rd and 4th gears

- Shoulder faces third gear
- Pressing off ⇒ Fig. 12
- Pressing on ⇒ Fig. 17

13 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item 4
- Re-determining thickness when replacing synchronizer body ⇒ Fig. 16

14 - Operating sleeve for 3rd and 4th gears

- Installed position ⇒ Fig. 18

15 - Synchronizer ring for 4th gear

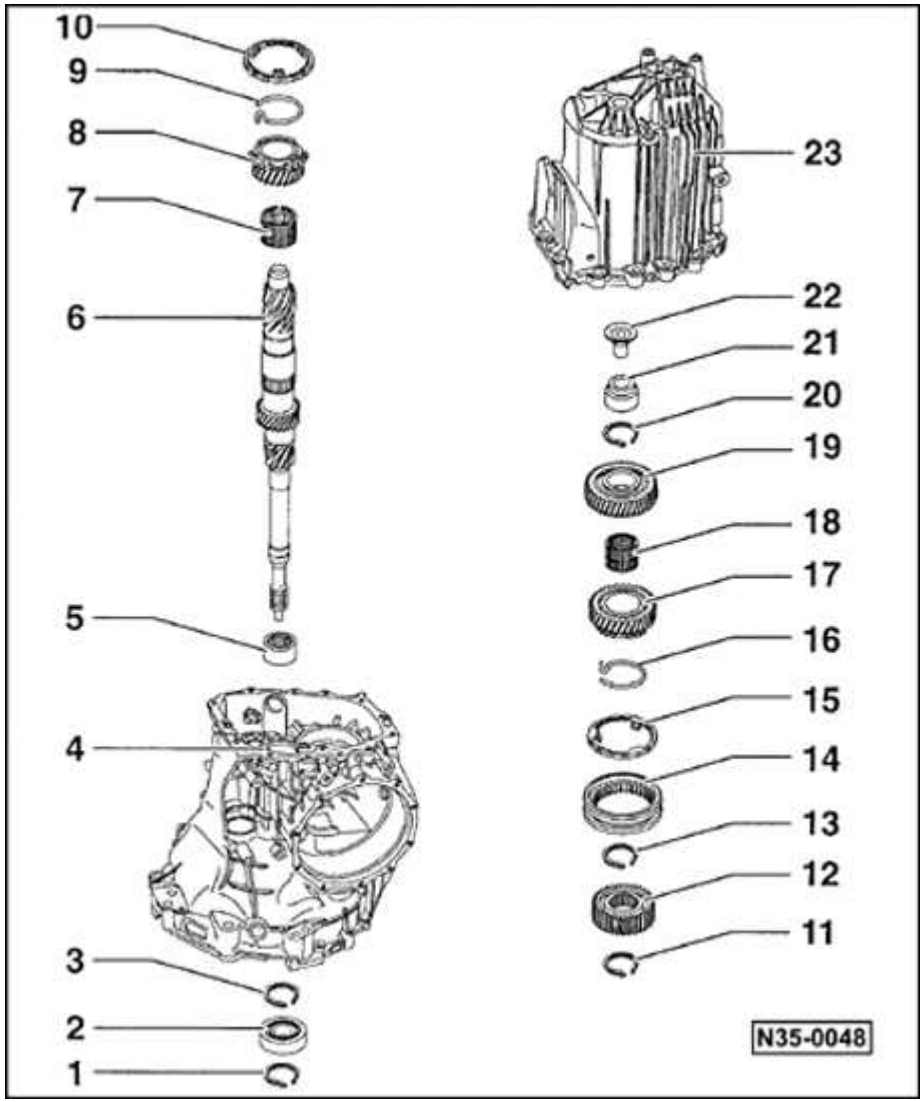
- Checking for wear ⇒ Fig. 14

16 - Spring

- Inserting in 4th gear ⇒ Fig. 13
- Allocation of spring to gear ⇒ parts catalog

17 - 4th gear

35-5



18 - Needle bearing for 4th gear

- Identification

19 - 5th gear

- Pressing off ⇒ Fig. 11
- Pressing on ⇒ Fig. 19

20 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -5-
- If 5th gear is replaced, re-determine thickness of circlip ⇒ Fig. 16

21 - Roller sleeve

- Always replace
- Damaged when removed
- Pulling out ⇒ Fig. 8
- Installed position ⇒ Fig. 9
- Driving in ⇒ Fig. 10

22 - Plastic sleeve

- Made of plastic

23 - Transmission cover

- With reverse idler gear ⇒ Page 35-44

- Coat sealing surfaces with a thin layer of sealant AMV 188 001 02

35-6

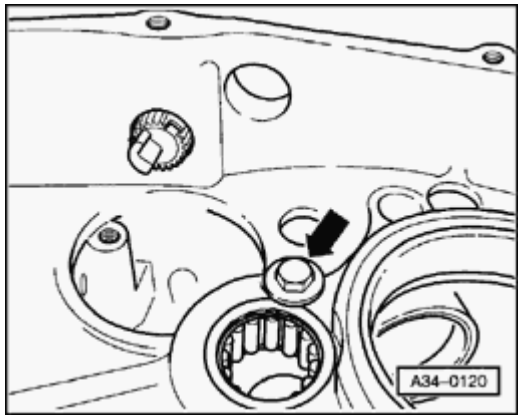


Fig. 1 Securing bolt for needle bearing

- Remove securing bolt (arrow).

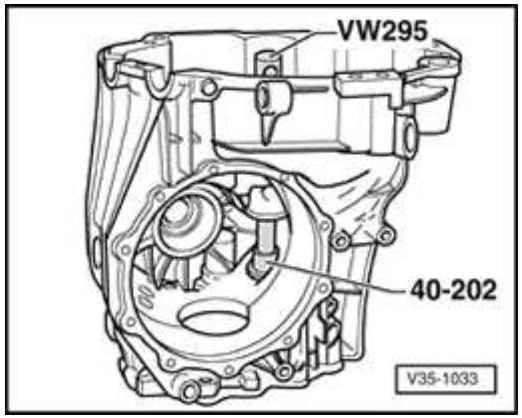


Fig. 2 Driving out needle bearing

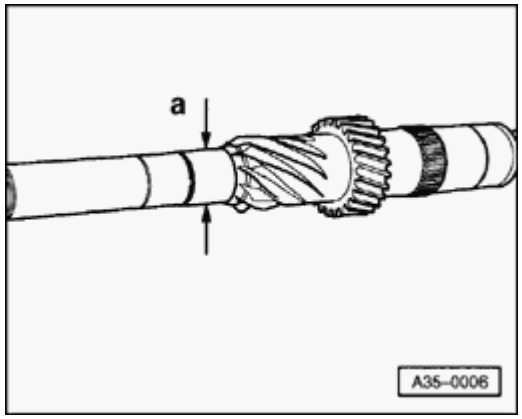


Fig. 3 Allocation of input shaft/needle bearing

Input shaft diameter	Needle bearing part number
a: 27 mm (1.062 in.)	012 311 123 D
a: 29 mm (1.141 in)	012 311 123

Notes:

To avoid damage due to improper assembly, check the following after replacing the input shaft:

- *Input shaft must be able to be guided in.*
- *Input shaft must have no play.*

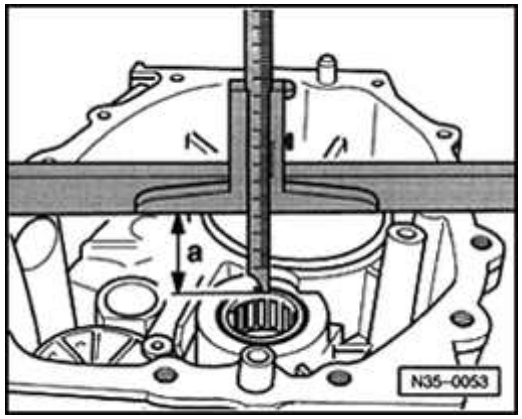


Fig. 4 Allocation of needle bearing

Dimension -a- from lower edge of straight-edge to upper edge of needle bearing: 39.5 mm (1.555 in.)

Note:

Measure the dimension from the top edge of the straight-edge and subtract the height of the straight-edge from the measured dimension.

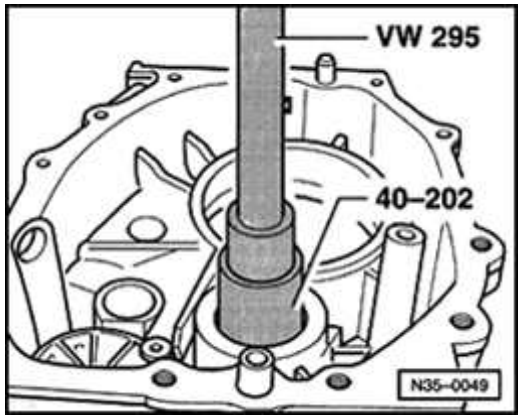


Fig. 5 Pressing in needle bearing

- Install securing bolt and tighten to 25 Nm (18 ft lb).

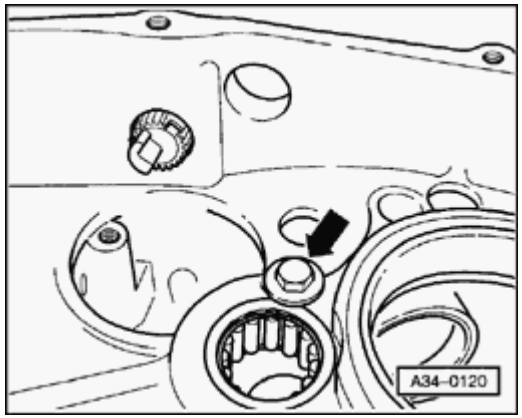


Fig. 6 Installing securing bolt (arrow)

Tightening torque: 25 Nm (18 ft lb).

35-9

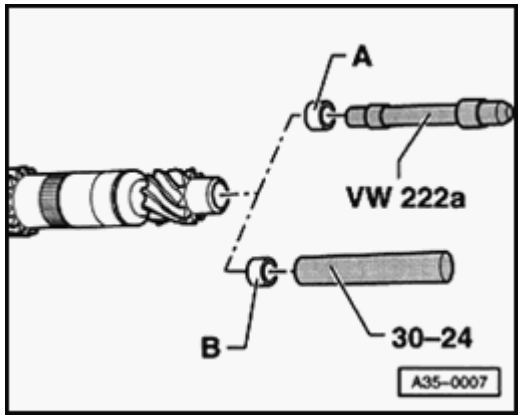


Fig. 7 Driving in oiling sleeve into input shaft

Item	Diameter of oiling sleeve	Tool
A	14 mm (0.551 in.)	VW222A pilot drift
B	16 mm (0.629 in.)	30-24 drift

Installed position: Flared edge of oiling sleeve faces tool

Installation depth: 3.5 mm (0.138 in.) below upper edge

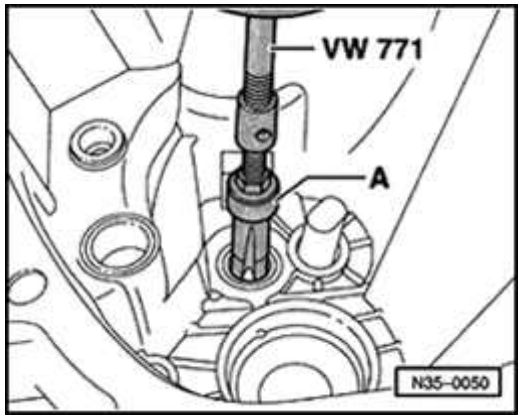


Fig. 8 Pulling out roller sleeve

A - Internal puller 22-28 mm, e.g. Kukko 21/4

Plastic sleeve inside roller sleeve must be destroyed to install internal puller.

35-10

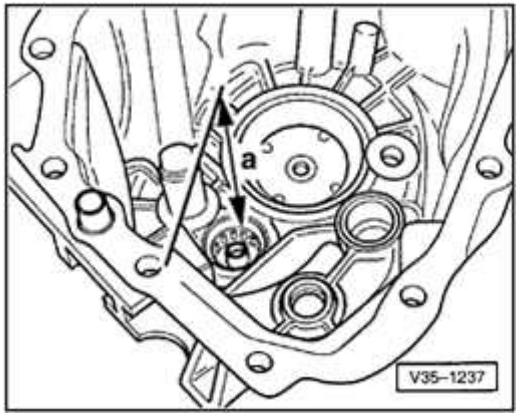


Fig. 9 Installed position of roller sleeve

Dimension -a- = 216 mm (8.5 in.)

Note:

Measure from upper edge of cover to upper edge of bearing.

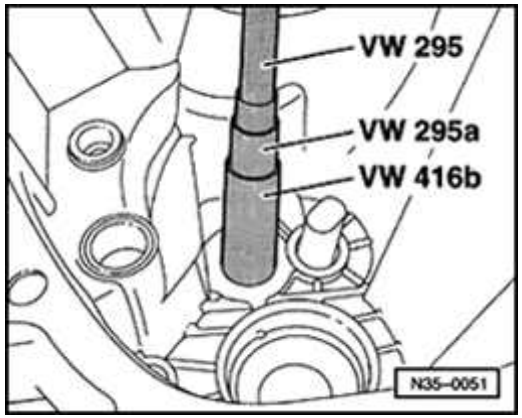


Fig. 10 Driving in roller sleeve

35-11

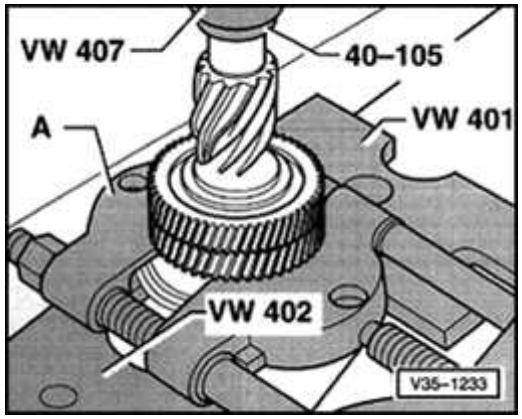


Fig. 11 Pressing off 5th gear

- Remove circlip before pressing off.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

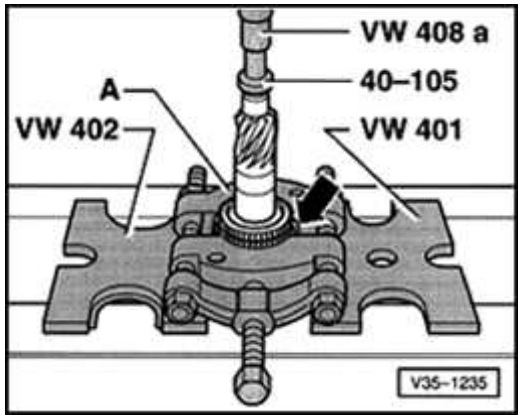


Fig. 12 Pressing off synchronizer hub for 3rd and 4th gears

- Remove circlip before pressing off.
- Press 3rd gear synchronizer ring (arrow) toward 3rd gear, and install separating device -A-.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

35-12

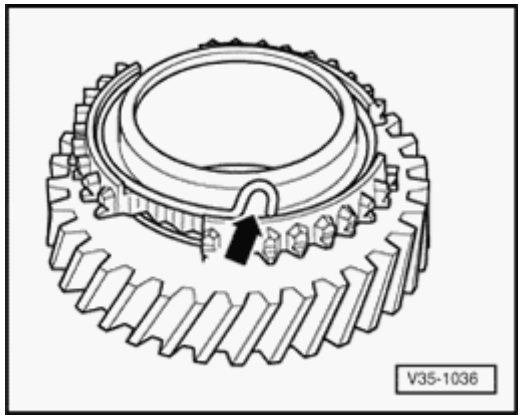


Fig. 13 Inserting spring into gear

The bent end of the spring (arrow) must be hooked into the hole of the gear.

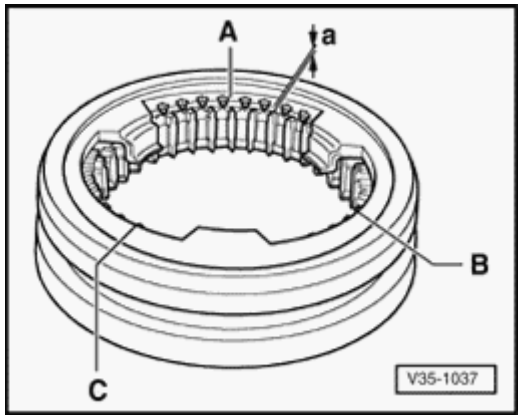


Fig. 14 Checking synchronizer ring for wear

- Press synchronizer ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add measured values and divide total by three to calculate average.

  The calculated gap must not be less than 0.5 mm (0.019 in.).

35-13

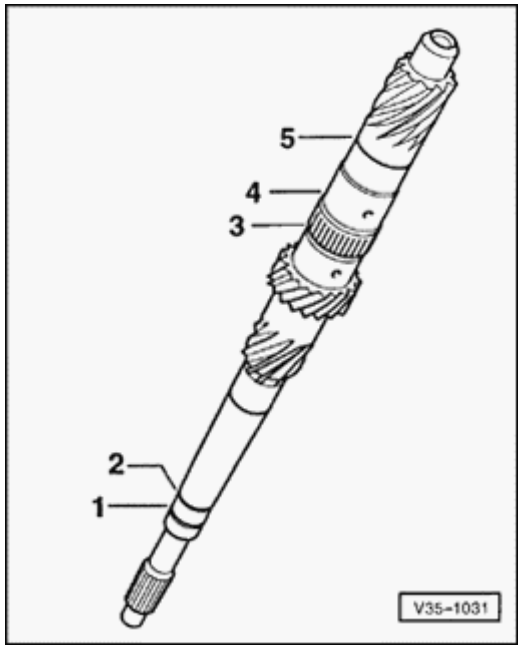


Fig. 15 Allocation of circlips

- Circlips -1- and -2- secure the input shaft ball bearing.

  Determining thickness ⇒ Page 35-17 , input shaft, adjusting

- Circlip -3- secures the 3rd and 4th gear synchronizer hub.

  Thickness: 2.00 mm (0.078 in.).

  Identification: brown in color.

- Circlip -4- secures the 3rd and 4th gear synchronizer hub.

  Determining thickness ⇒ Page 35-14 , table

  Identification: blue in color.

- Circlip -5- secures the 5th gear.

  Determining thickness ⇒ Page 35-14 , table

35-14

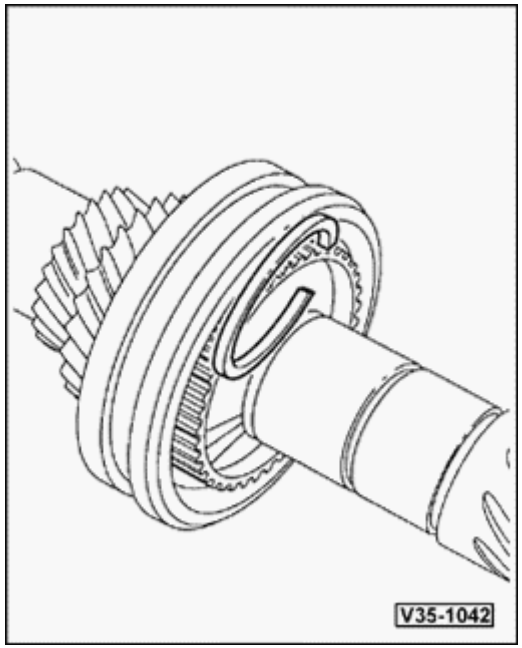


Fig. 16 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Determine circlip according to table. Part number ⇒ parts catalog

The following circlips are available for synchronizer hub for 3rd and 4th gear

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

The following circlips are available for 5th gear

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

35-15

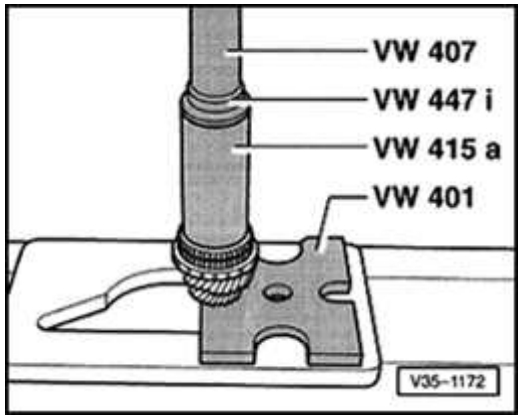


Fig. 17 Pressing on synchronizer hub for 3rd and 4th gears

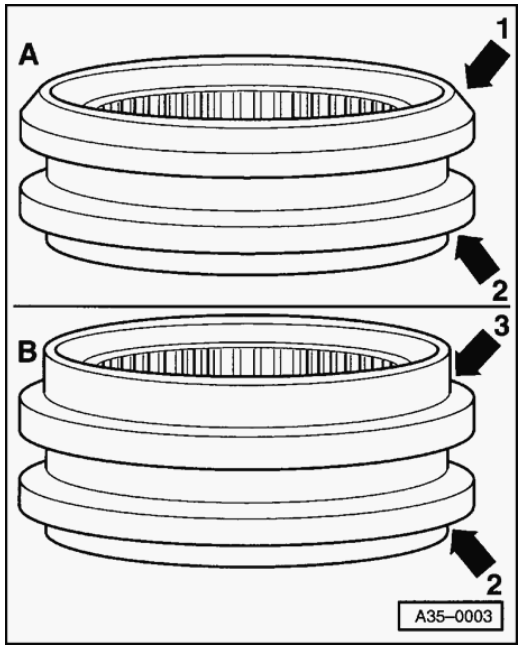


Fig. 18 Installation position of operating sleeve

Operating sleeves with chamfer -A- as well as operating sleeves with a large offset -B- are installed.

Installed position:

- The chamfer (arrow -1-) faces 4th gear
- The small stepped side (arrow -2-) faces 3rd gear
- The large stepped side (arrow -3-) faces 4th gear

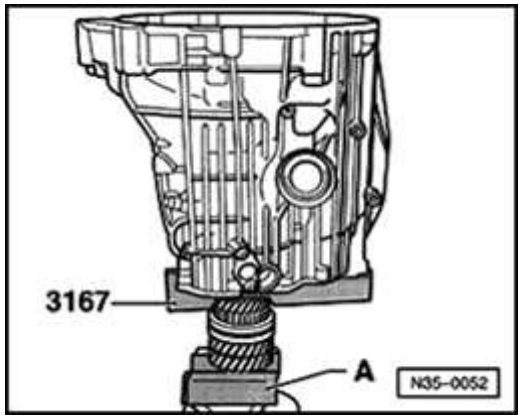


Fig. 19 Pressing on 5th gear

WARNING!

Wear protective gloves!

- Heat 5th gear to approx. 100 ° C (212 ° F) before pressing on.

Installation position: shoulder faces reverse gear.

Drive pinion and hollow shaft, disassembling and assembling

Special tools, testers and auxiliary items required:

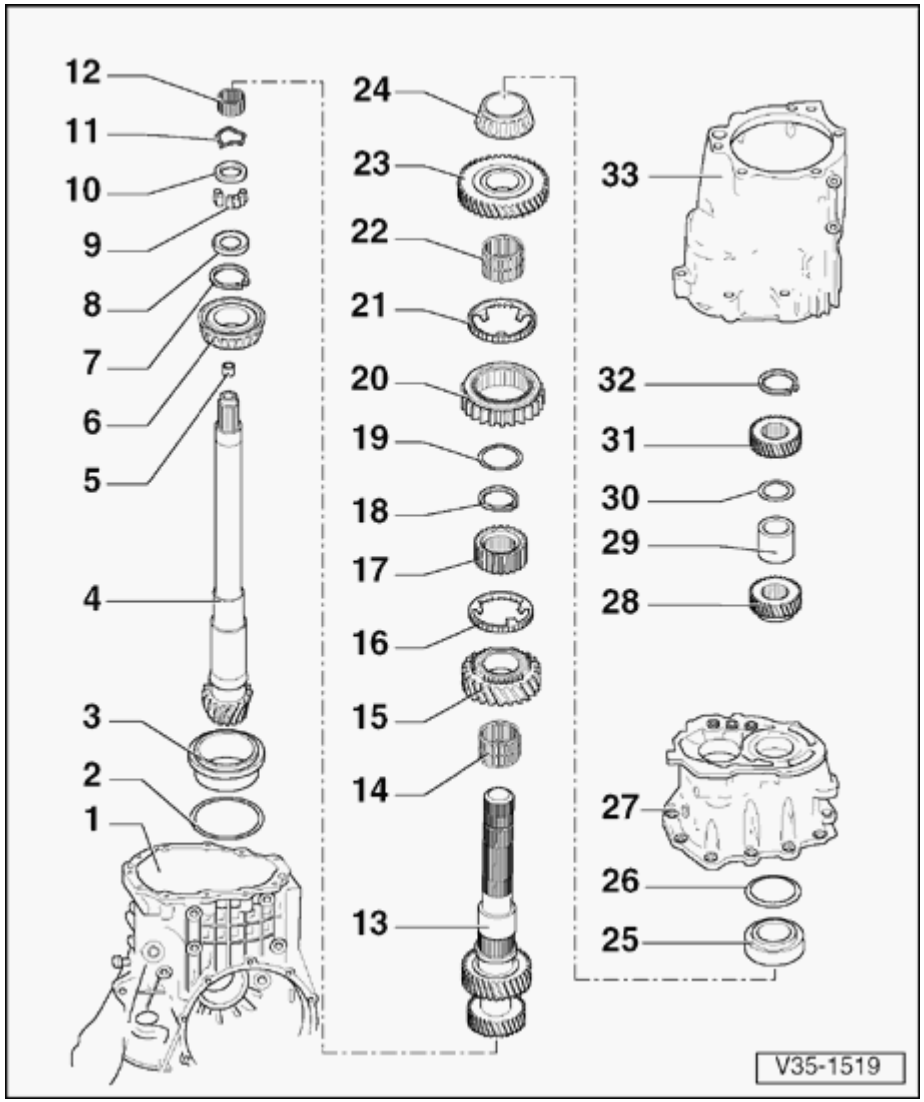
- Multi-purpose tool 771/1 with attachment 771/15
- Installing sleeve 2003/3
- Punch 3013
- Thrust pad 3062
- Thrust piece 3118
- Drift 3138
- Drift VW 295
- Thrust plate VW 401
- Thrust plate VW 402

- Press tool VW 407
- Press tool VW 411

35-14

- Press tool VW 412
- Tube VW 415a
- Support rails VW 457
- Separating device 22-115 mm (e.g. Kukko 17/2)
- Internal puller 12-14.5 mm (e.g. Kukko 22/1)
- Hot air blower V.A.G 1416

35-15



Note:

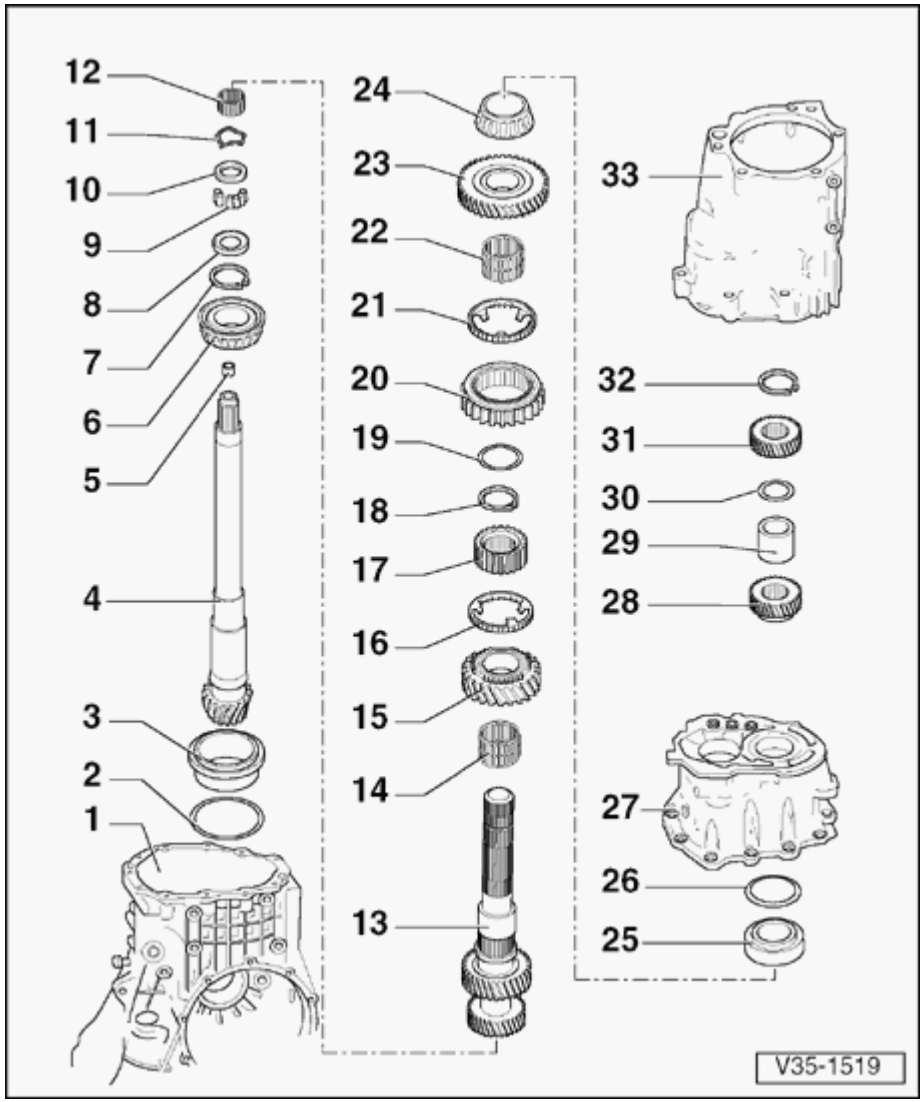
- *When installing new gears or final drive set ⇒ Page 00-3 , Technical data*
- *Adjustments are required when replacing components marked 1) ⇒ Page 39-37 , Adjustment overview*

1 - Gearbox housing

- Servicing ⇒ Page 34-127

2 - Shim "S3"

- Adjustment overview ⇒ Page 39-37



3 - Outer race for large tapered roller bearing 1)

- Pulling out ⇒ Fig. 1
- Pressing in ⇒ Fig. 2 and ⇒ Fig. 3

4 - Drive pinion 1)

- Paired with ring gear (final drive set)

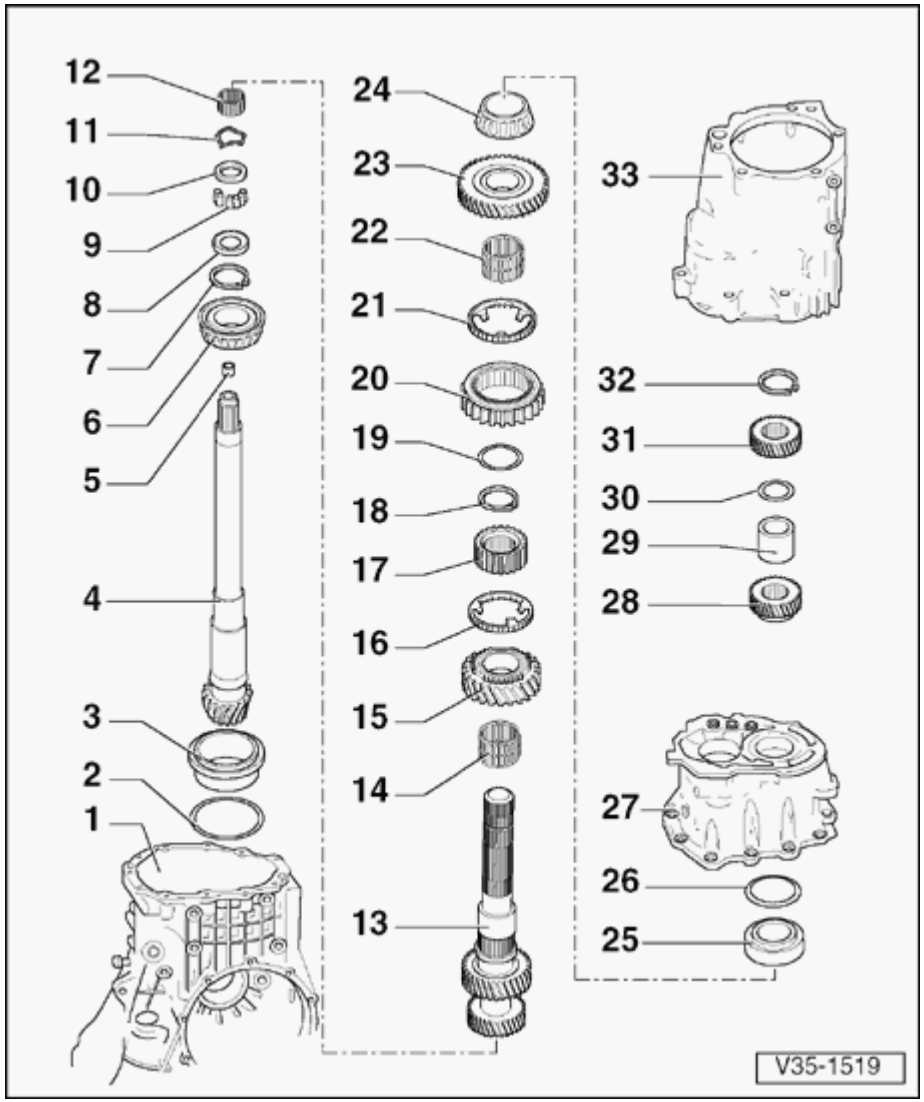
5 - Needle bearing for flange shaft/drive pinion

- Pulling out ⇒ Fig. 4
- Driving in ⇒ Fig. 5

6 - Inner race for large tapered roller bearing 1)

- Pressing off ⇒ Fig. 6
- Pressing on ⇒ Fig. 7
- Low-friction bearing; do not oil when measuring friction torque

35-17



7 - Circlip

- Re-determining ⇒ Fig. 8

8 - Flange ring

- Installation position ⇒ Page 34-68

9 - Tapered rollers

- Qty. 23
- Installation position ⇒ Page 34-68

10 - Support ring

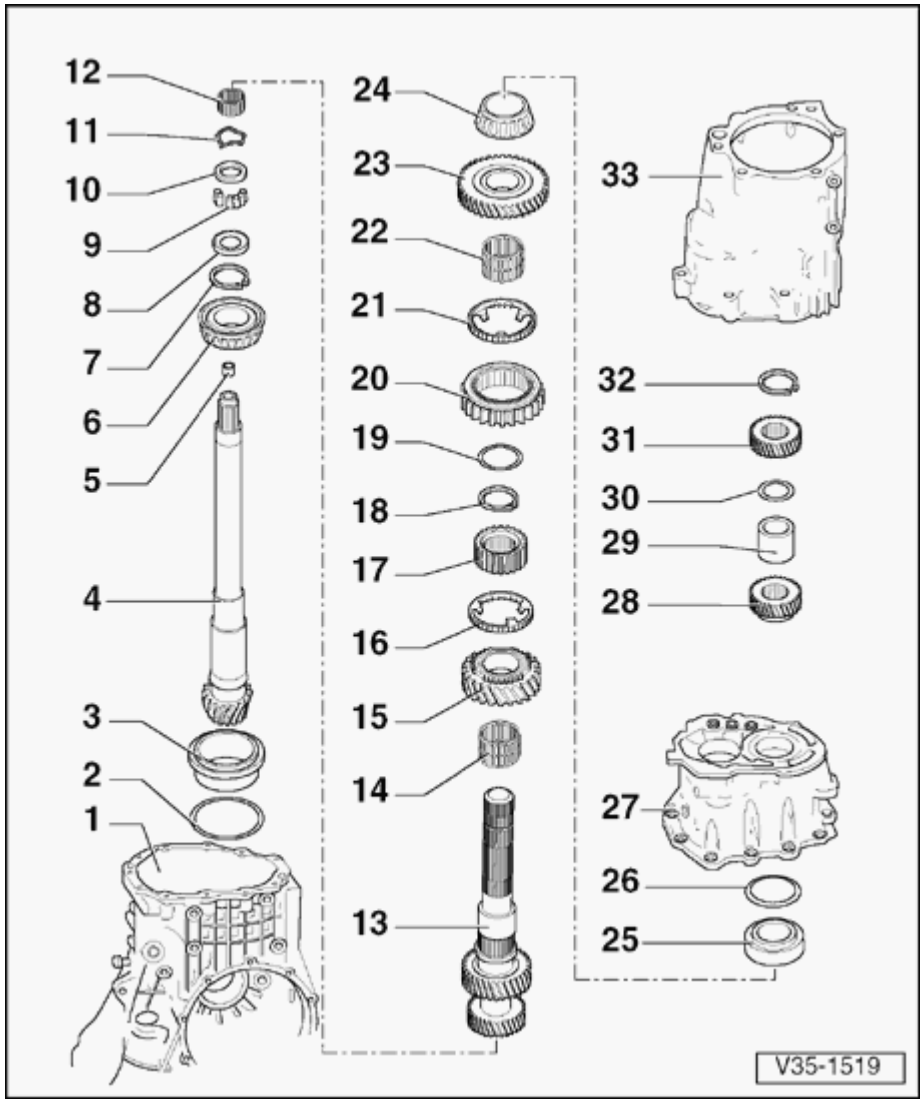
- Installation position ⇒ Page 34-68

11 - Corrugated spring

12 - Needle bearing for drive pinion/hollow shaft

- Oil before installing

13 - Hollow shaft with 3rd and 4th speed gears **1)**



14 - Needle bearing for 2nd speed sliding gear

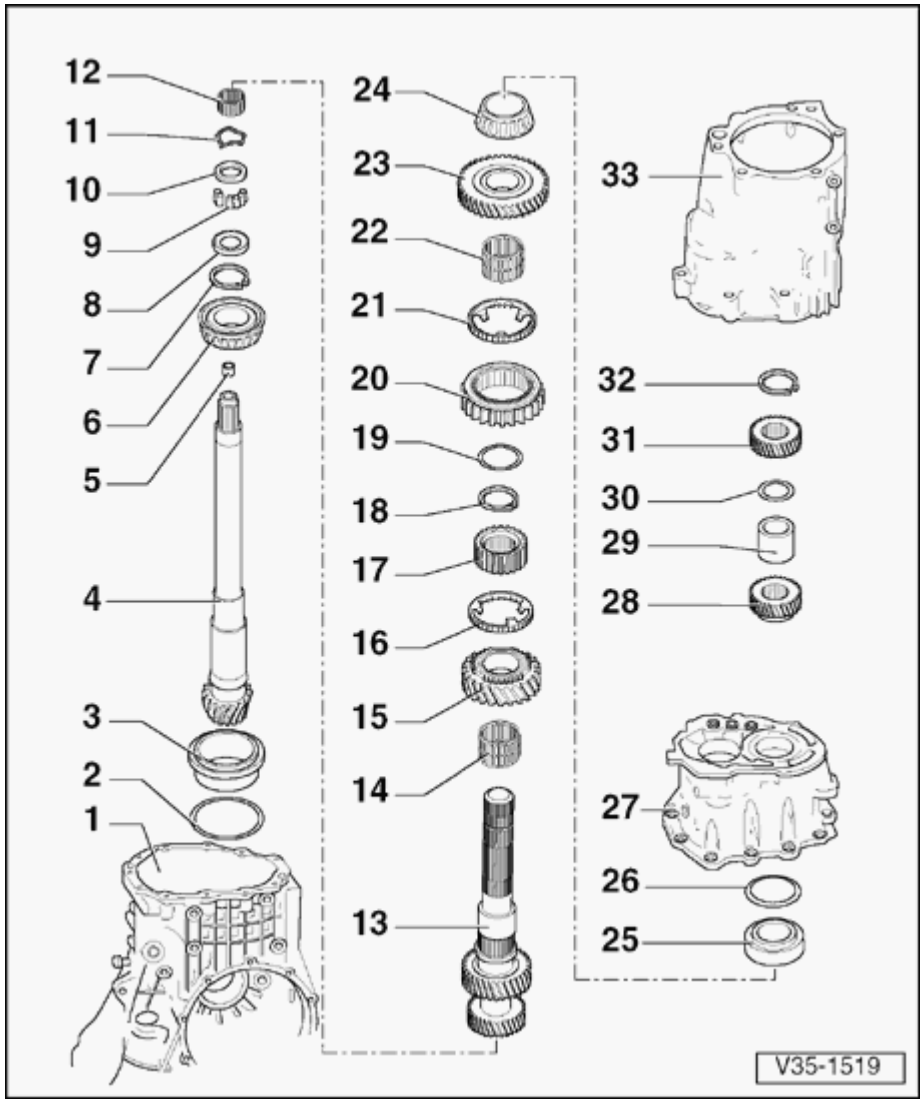
- Split
- Oil with gear oil before installing

15 - 2nd speed sliding gear

- Pressing off ⇒ Fig. 12
- Before installing, fit spring and slide needle bearing onto hollow shaft
- After installing, check axial clearance with a feeler gauge (0.15-0.35 mm)

16 - Synchro-ring for 2nd gear

- Coated with Molybdenum
- Checking for wear ⇒ Fig. 2 , ⇒ Page 35-9



17 - Synchro-hub for 1st and 2nd gear

- Pressing off ⇒ Fig. 12
- Pressing on ⇒ Fig. 13
- Installation position: flush hub towards 2nd speed sliding gear

18 - Circlip

- Removing and installing ⇒ Fig. 11
- Re-determining ⇒ Fig. 8

19 - Washer

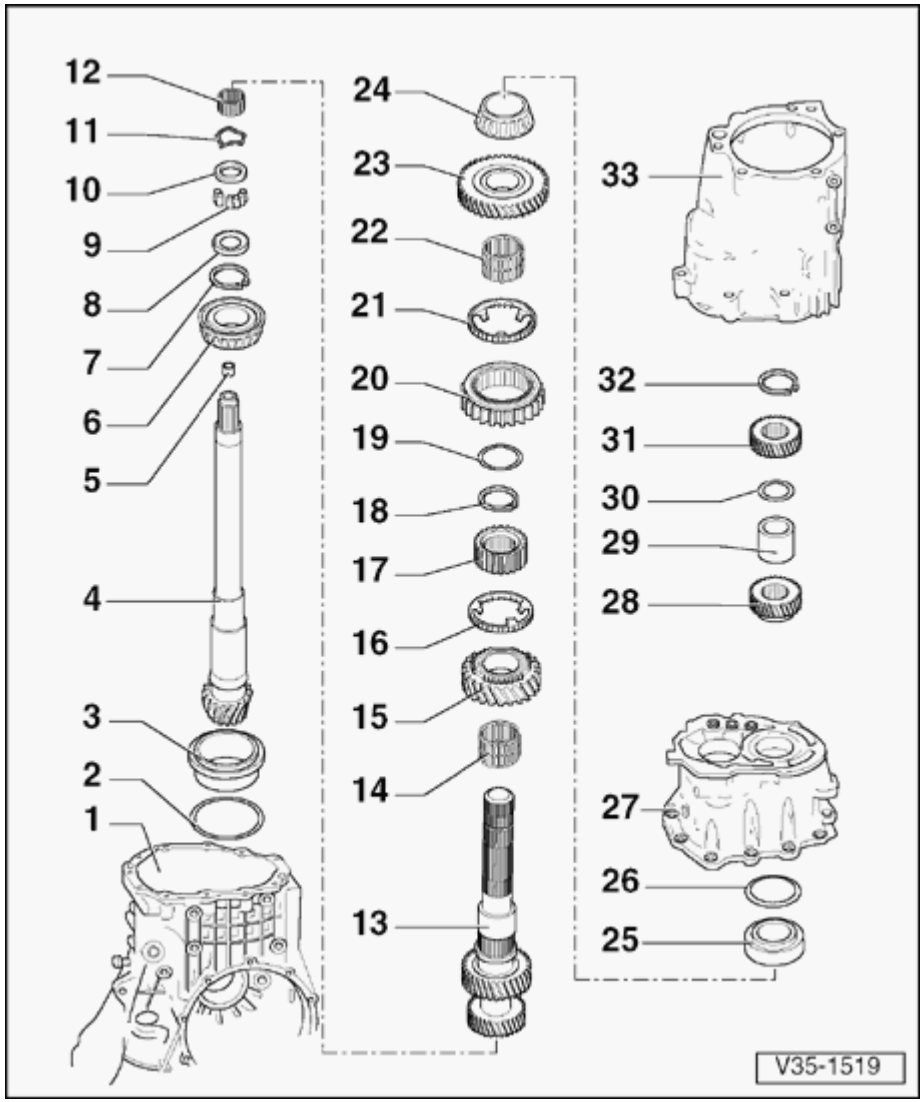
- Removing and installing ⇒ Fig. 11

20 - Locking collar for 1st and 2nd gear

- Installation position: splines for reverse gear towards synchro-ring for 2nd gear

21 - Synchro-ring for 1st gear

- Checking for wear ⇒ *Fig. 2* , ⇒ Page 35-9



22 - Needle bearing for 1st speed sliding gear

- Oil with gear oil before installing

23 - 1st speed sliding gear

- Before installing, insert spring ⇒ *Fig. 1* , ⇒ Page 35-9
- After pressing on -item 24 -, check axial clearance

24 - Inner race for small tapered roller bearing 1)

- Pressing off ⇒ Fig. 9
- Pressing on ⇒ Fig. 10
- Low friction bearing; do not oil when measuring friction torque

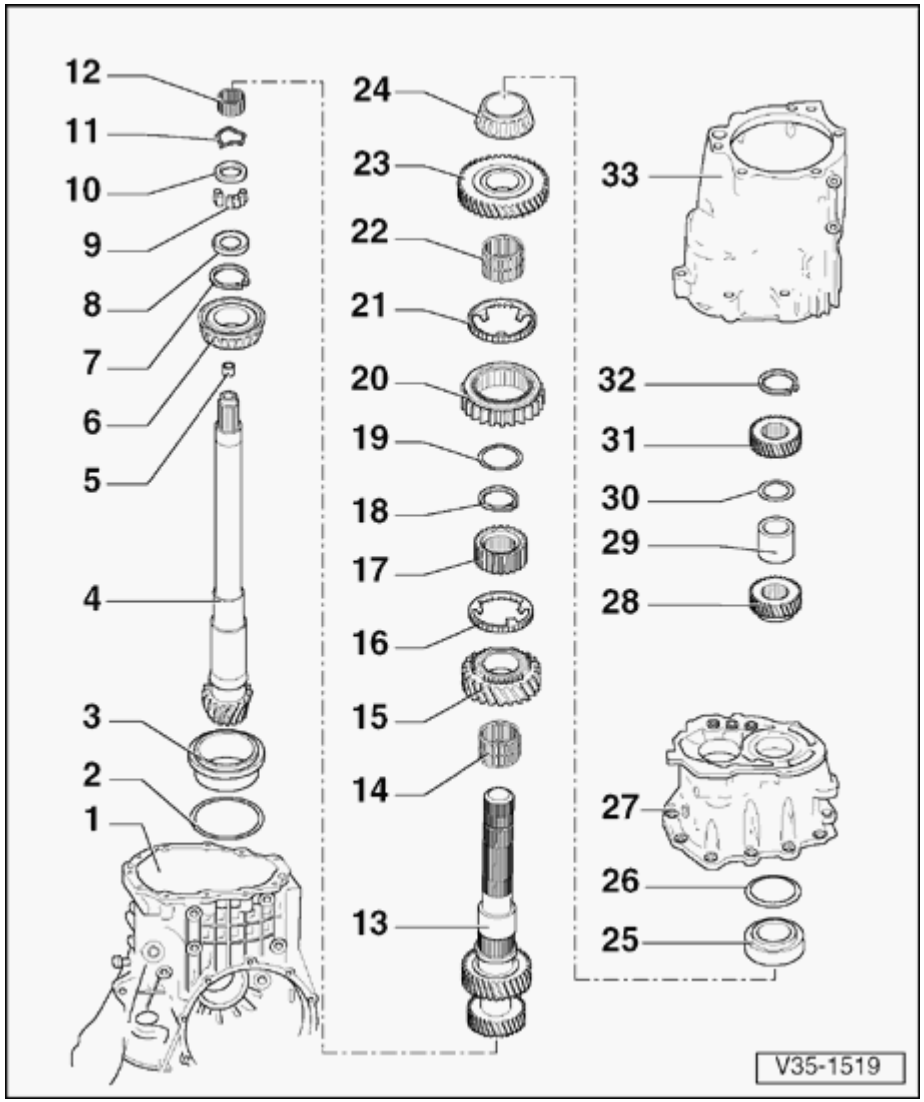
25 - Outer race for small tapered roller bearing 1)

- Driving out ⇒ Fig. 15
- Pressing in ⇒ Fig. 16

26 - Shim "S4"

- Adjustment overview ⇒ Page 39-37

35-21



27 - Bearing plate [1)]

- Servicing ⇒ Page 34-112

28 - 6th gear wheel

- Pressing off ⇒ Page 34-68
- Pressing on ⇒ Page 34-69
- Installation position: shoulder towards inner race for small tapered roller bearing

29 - Spacer sleeve

30 - Shim

- Re-determining ⇒ Page 34-78

31 - 5th gear wheel

- Pulling off ⇒ Page 34-62
- Driving on ⇒ Page 34-79

32 - Circlip for 5th gear wheel

- Re-determining ⇒ Page 34-80

33 - End cover

- Servicing ⇒ Page 34-103

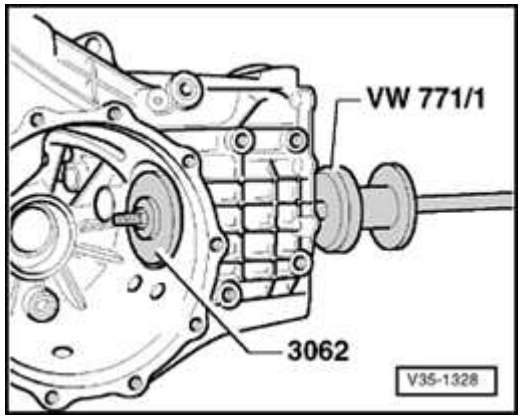


Fig. 1 Pulling out outer race for large tapered roller bearing

- Stepped side of thrust pad 3062 rests against the outer race

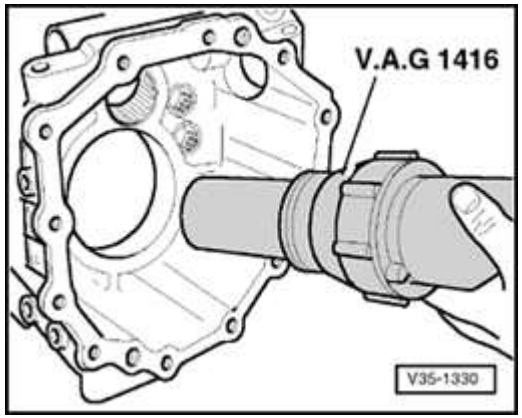


Fig. 2 Heating gearbox housing to insert the outer race for large tapered roller bearing

- Heat gearbox housing in area of bearing seat for approx. 15 minutes, to approx. 100 ° C, with a hot air blower.

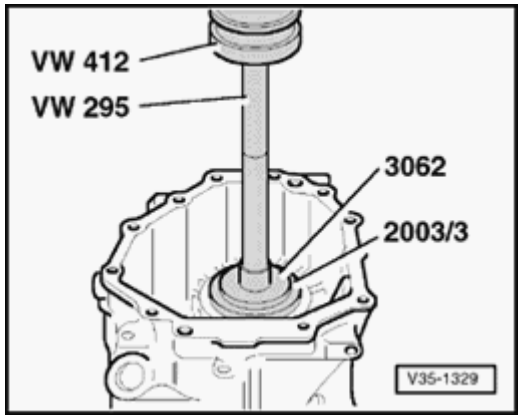


Fig. 3 Inserting outer race for large tapered roller bearing in gearbox housing and pressing home

- Insert outer race only after heating gearbox housing and press home for 1-2 minutes under a repair press until a heat exchange has taken place.

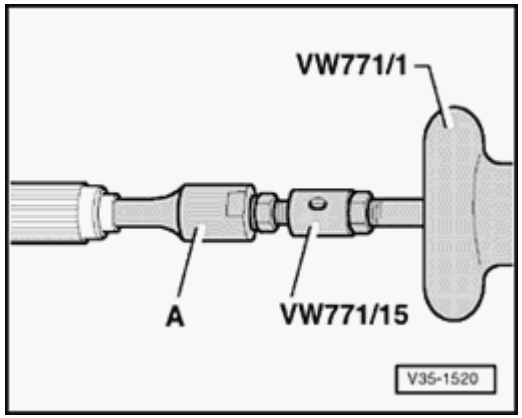


Fig. 4 Pulling out needle bearing for flange shaft/drive pinion

A - Internal puller 12-14.5 mm, e.g. Kukko 21/1

35-24

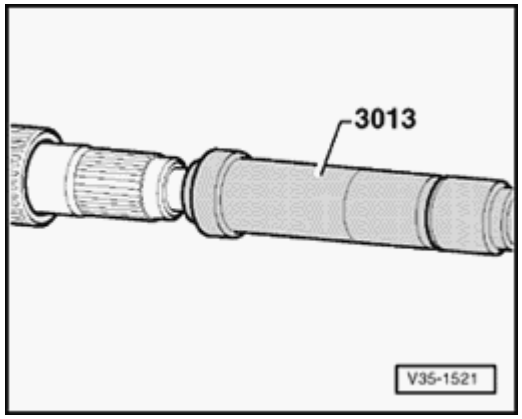


Fig. 5 Driving needle bearing for flange shaft/ drive pinion in flush

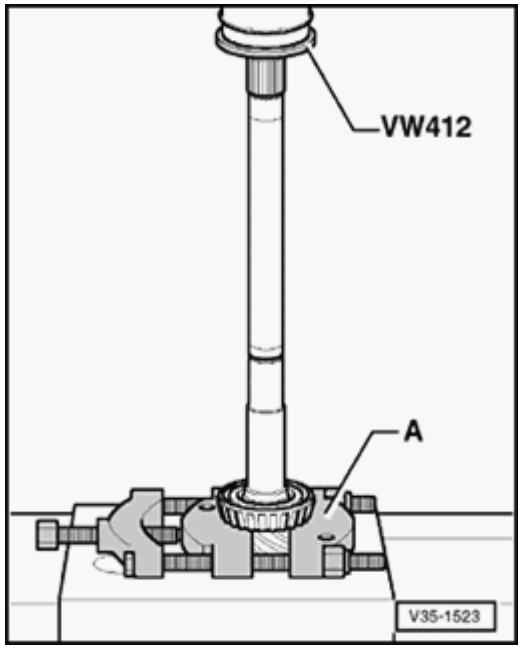


Fig. 6 Pressing off inner race for large tapered roller bearing

A - Separating device 22-115 mm, e.g. Kukko 17/2

- Bearing is destroyed when pressing off

35-25

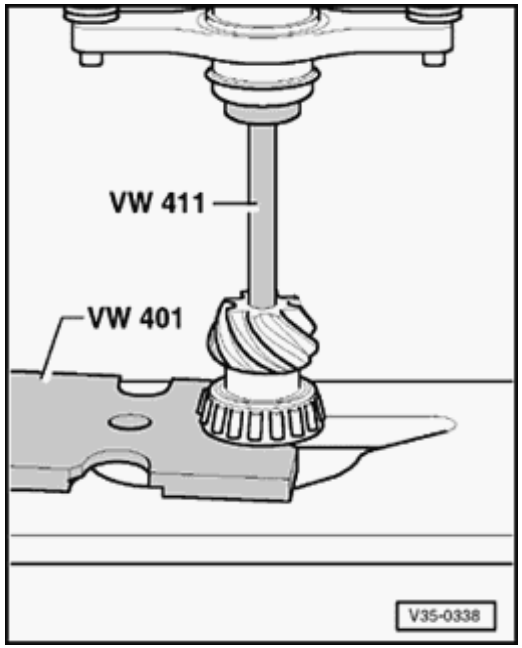


Fig. 7 Pressing on inner race for large tapered roller bearing

- Heat inner race to approx. 100 ° C and fit.
- Press home ensuring there is no axial play.

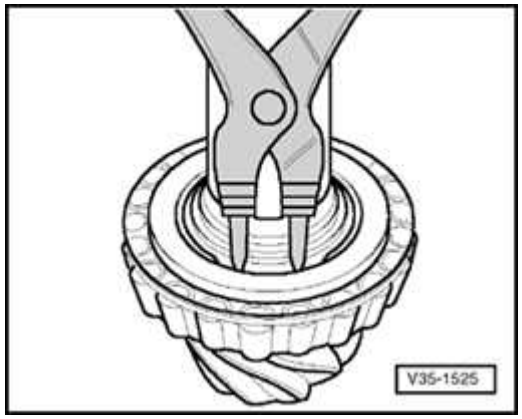


Fig. 8 Determining circlip for large tapered roller bearing for drive pinion

- Determine thickest circlip that can still just be fitted.
- Determine circlip from table.

⇒ *Parts catalog*

The following circlips are available:

Circlip thickness (mm)		
2.34	2.40	2.46
2.36	2.42	2.48
2.38	2.44	

- Fit circlip.

35-27

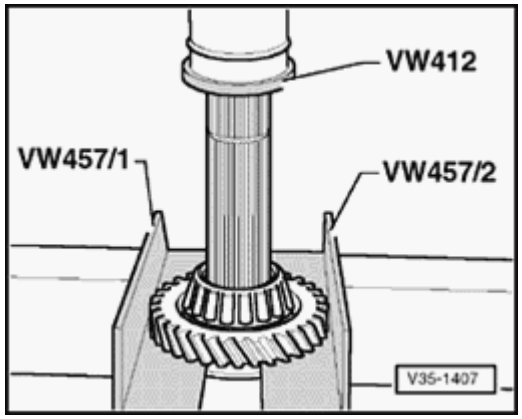


Fig. 9 Pressing off inner race of small tapered roller bearing for drive pinion together with 1st speed sliding gear

Note:

Do not press off together with 1st and 2nd gear synchro-hub and 2nd speed sliding gear.

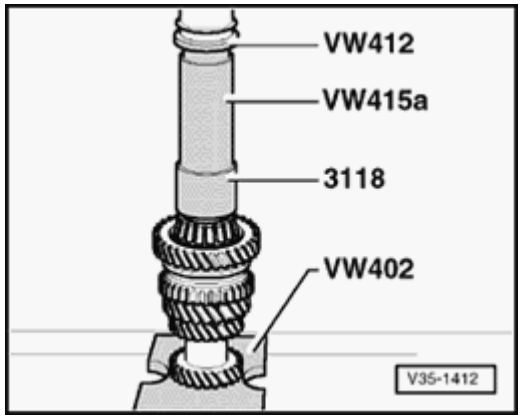


Fig. 10 Pressing on inner race for small tapered roller bearing for drive pinion together with 1st speed sliding gear

- Install circlip, shim for 1st speed sliding gear, synchro-ring for 1st speed, and 1st speed sliding gear with spring and needle bearing.
- Heat inner race to approx. 100 ° C and fit.
- Press home ensuring there is no axial play.

Note:

- *With shoulder of thrust piece 3118 facing downwards, press only onto bearing inner race.*
- *Position stepped shoulder of tube VW 415 A facing up towards press tool VW 412.*
- *After pressing on, check axial clearance of 1st speed sliding gear.*

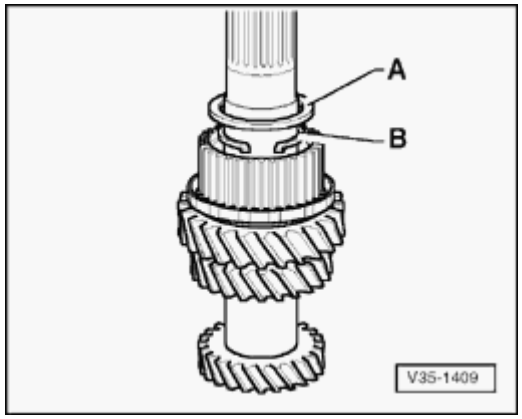


Fig. 11 Removing and installing circlip for synchro-hub and shim for 1st speed sliding gear

- Removing: take off shim -A- then circlip -B-.
- Installing: fit circlip -B- then shim -A-.

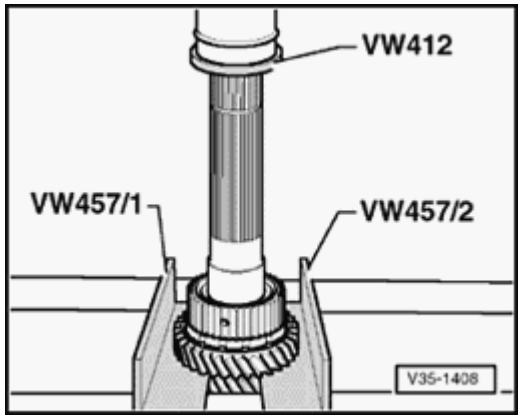


Fig. 12 Pressing off 2nd speed sliding gear with synchro-hub for 1st and 2nd gear

- Take off locking collar for 1st and 2nd gear and synchro-ring for 1st gear.
- Remove shim and circlip for synchro-hub.
- Press off 2nd speed sliding gear together with synchro-hub for 1st and 2nd gear.

Note:

Do not press off together with 1st speed sliding gear and inner race for small tapered roller bearing.

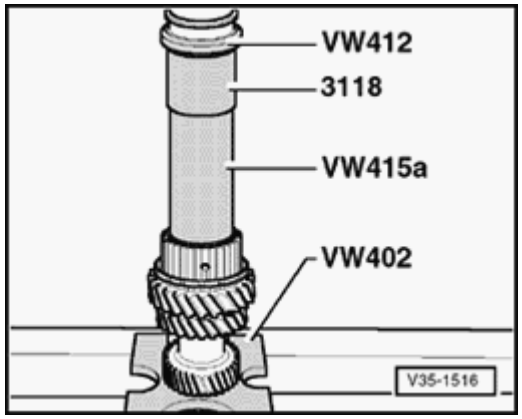


Fig. 13 Fitting 2nd speed sliding gear, pressing on synchro-hub for 1st and 2nd gear

- Install needle bearing (split), sliding gear with spring and synchro-ring for 2nd gear.
- Oil needle bearing.
- Heat synchro-hub to approx. 100 ° C and fit.
- Press home ensuring there is no axial play.

Note:

- *Position tube VW 415 a with shoulder towards synchro-hub.*
- *Position thrust pad 3118 with stepped shoulder towards press tool VW 412.*

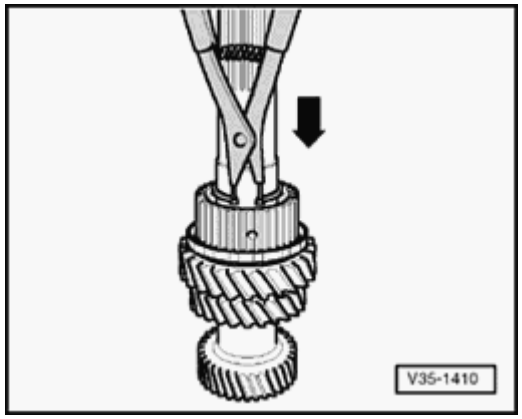


Fig. 14 Determining thickness of circlip for synchro-hub for 1st and 2nd gear

- Determine thickest circlip that can still just be fitted.
- Determine circlip from table.

⇒ *Parts catalog*

The following circlips are available:

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

- Fit circlip in direction of arrow onto synchro-hub.

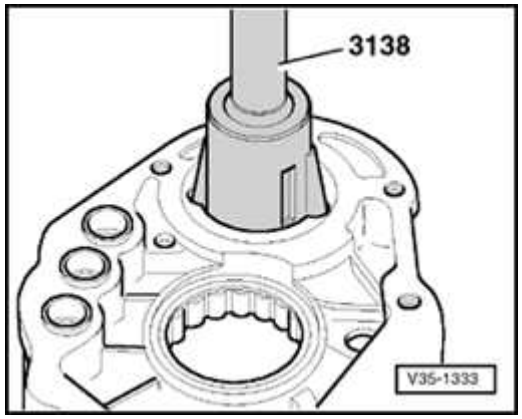


Fig. 15 Driving out outer race for small tapered roller bearing

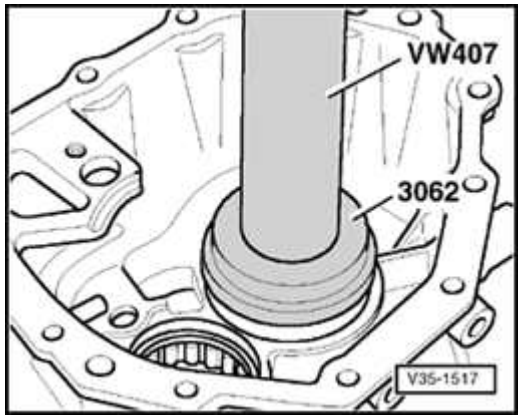


Fig. 16 Pressing in outer race for small tapered roller bearing

- Insert shim "S4" into bearing flange behind bearing seat.
- Position stepped shoulder of thrust pad 3062 towards press tool VW 407.
- Press outer race for small tapered roller bearing onto stop.

35-17

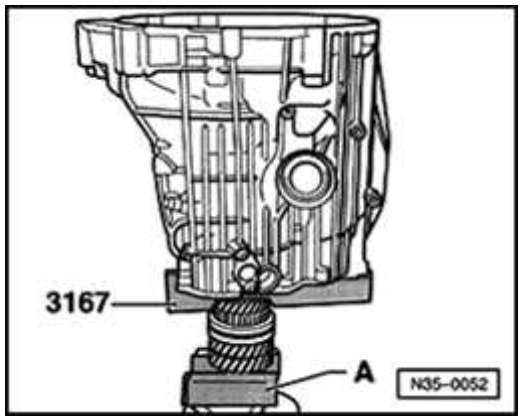
Input shaft, adjusting

Note:

The input shaft must be re-adjusted if the transmission housing, input shaft or ball bearing is replaced.

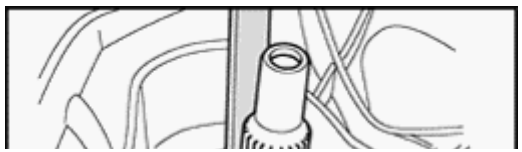
Special tools and equipment

- 30-100 press tube
- 3167 spacer gauge
- Depth gauge



- Clamp input shaft in vice using protective jaws -A-.
- Place 3167 spacer gauge onto 3rd gear.
- Place transmission housing over input shaft onto spacer gauge.

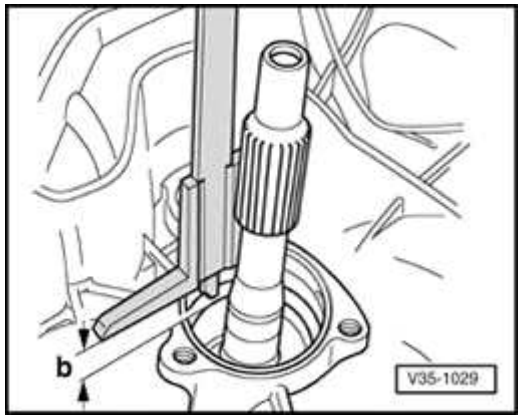
Calculating dimension -x-



- Place depth gauge onto transmission housing and measure to lower circlip groove of input shaft.

Dimension in the example: -a- = 28.50 mm (1.122 in.)

35-18



- Place depth gauge onto transmission housing and measure to seating surface for ball bearing.

  Measurement in the following example: -b- = 26.80 mm (1.055 in.)

Determining circlip thickness behind the input shaft ball bearing

Formula:

x = a - b

Example:

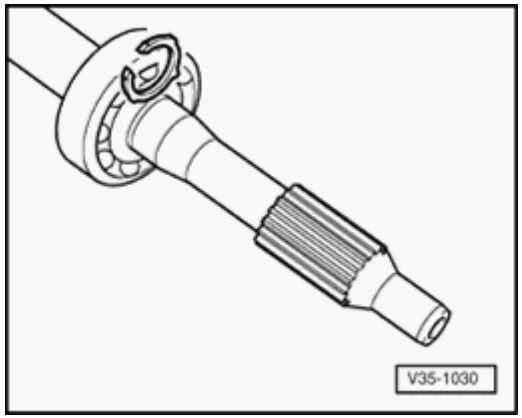
	Dimension -a-	28.50 mm
-	Dimension -b-	26.80 mm
=	Dimension -x- (thickness of circlip)	1.70 mm

- Determine circlip thickness according to table ⇒ Page 35-19 .

  For part number ⇒ parts catalog

Available circlips

Dimension -x- (mm)	Thickness (mm)
1.48 - 1.56	1.54
1.57 - 1.65	1.63
1.66 - 1.74	1.72
1.75 - 1.83	1.81
1.84 - 1.92	1.90
1.93 - 2.01	1.99
2.02 - 2.10	2.08
2.11 - 2.20	2.17



Determining circlip thickness in front of input shaft ball bearing

- Drive rear circlip (as calculated) and ball bearing onto input shaft using 30-100 press tube.

- Determine thickest circlip which can still just be installed.
- Determine circlip thickness according to table.

  Part number ⇒ parts catalog

Available circlips

Circlip thickness (mm)		
1.45	1.72	1.99
1.54	1.81	2.08
1.63	1.90	2.17

35-17

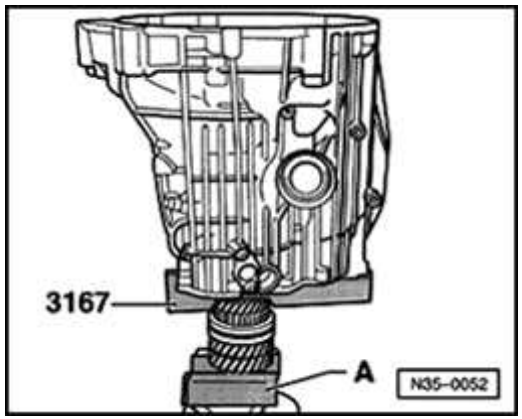
Input shaft, adjusting

Note:

The input shaft must be re-adjusted if the transmission housing, input shaft or ball bearing is replaced.

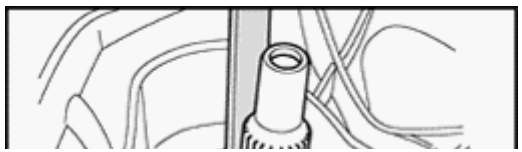
Special tools and equipment

- 30-100 press tube
- 3167 spacer gauge
- Depth gauge



- Clamp input shaft in vice using protective jaws -A-.
- Place 3167 spacer gauge onto 3rd gear.
- Place transmission housing over input shaft onto spacer gauge.

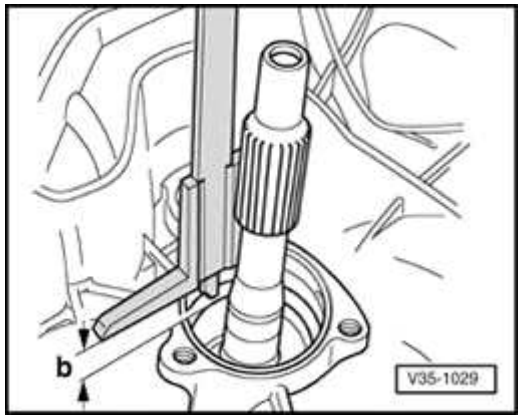
Calculating dimension -x-



- Place depth gauge onto transmission housing and measure to lower circlip groove of input shaft.

Dimension in the example: -a- = 28.50 mm (1.122 in.)

35-18



- Place depth gauge onto transmission housing and measure to seating surface for ball bearing.

  Measurement in the following example: -b- = 26.80 mm (1.055 in.)

Determining circlip thickness behind the input shaft ball bearing

Formula:

x = a - b

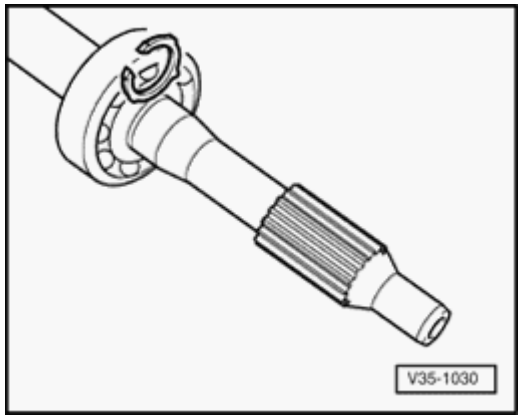
Example:

	Dimension -a-	28.50 mm
-	Dimension -b-	26.80 mm
=	Dimension -x- (thickness of circlip)	1.70 mm

- Determine circlip according to table ⇒ Page 35-19 . For part number ⇒ parts catalog

Available circlips

Dimension -x- (mm)	Thickness (mm)
1.48 - 1.56	1.54
1.57 - 1.65	1.63
1.66 - 1.74	1.72
1.75 - 1.83	1.81
1.84 - 1.92	1.90
1.93 - 2.01	1.99
2.02 - 2.10	2.08
2.11 - 2.20	2.17



Determining the circlip in front of input shaft ball bearing

- Drive rear circlip (as calculated) and ball bearing onto input shaft using 30-100 press tube.

- Determine thickest circlip which can still just be installed.
- Determine circlip according to table. Part number ⇒ parts catalog

Available circlips

Circlip thickness (mm)		
1.45	1.72	1.99
1.54	1.81	2.08
1.63	1.90	2.17

Drive pinion and hollow shaft, disassembling and assembling

Special tools and equipment

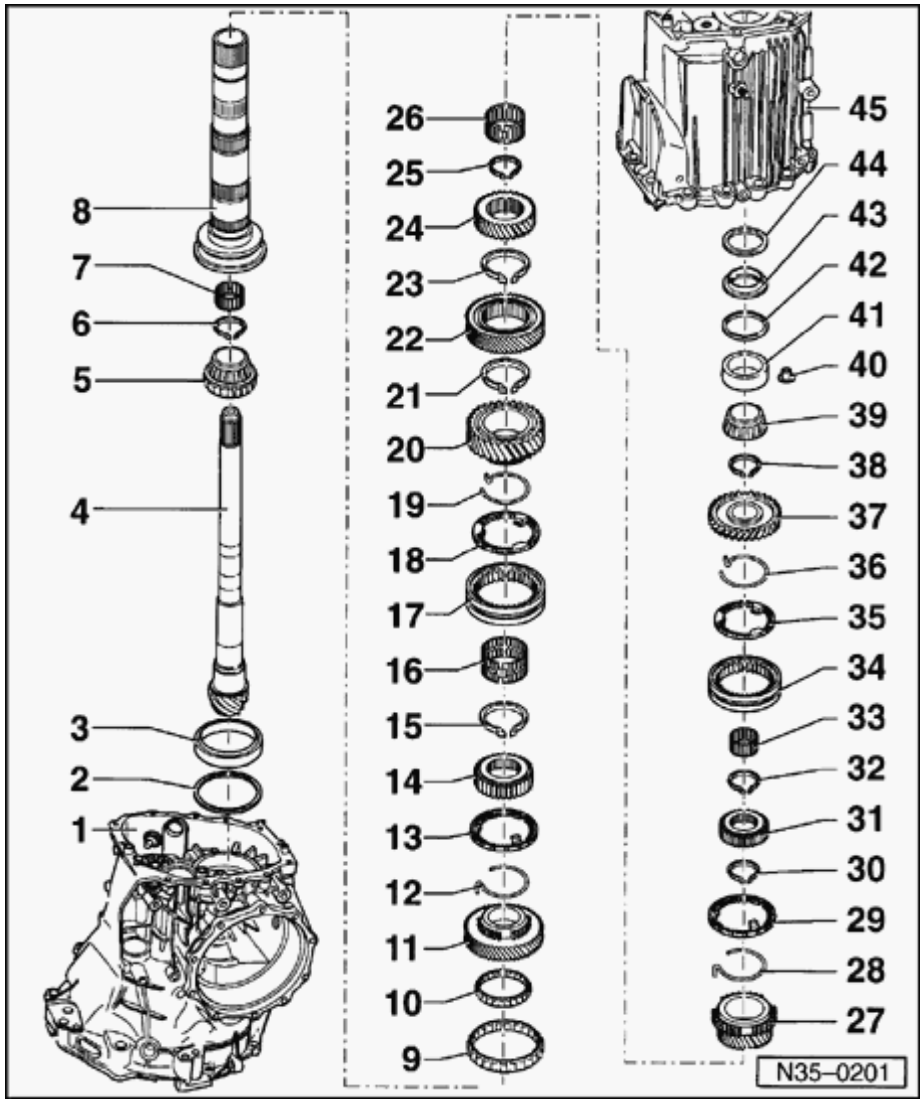
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW411 punch
- VW412 thrust disc
- 415A tube
- 416B tube
- 418A tube
- 429 thrust ring
- VW4471 thrust pad

- VW454 thrust tube
- VW519 sleeve
- VW771 slide hammer-complete set

35-22

- 40-103 sleeve
- 2010 sleeve
- 3062 thrust pad
- 3128 bushing puller
- Kukko 17/2 separating tool
- Kukko 21/1 puller

35-23



Notes:

- *When installing new gears or the final drive set, consult technical data ⇒ Page 00-3 .*
- *Adjustments are required when replacing components marked by1) ⇒ Page 39-37 , List of adjustments*

1 - Transmission housing

2 - Shim S3

- List of adjustments overview ⇒ Page 39-37

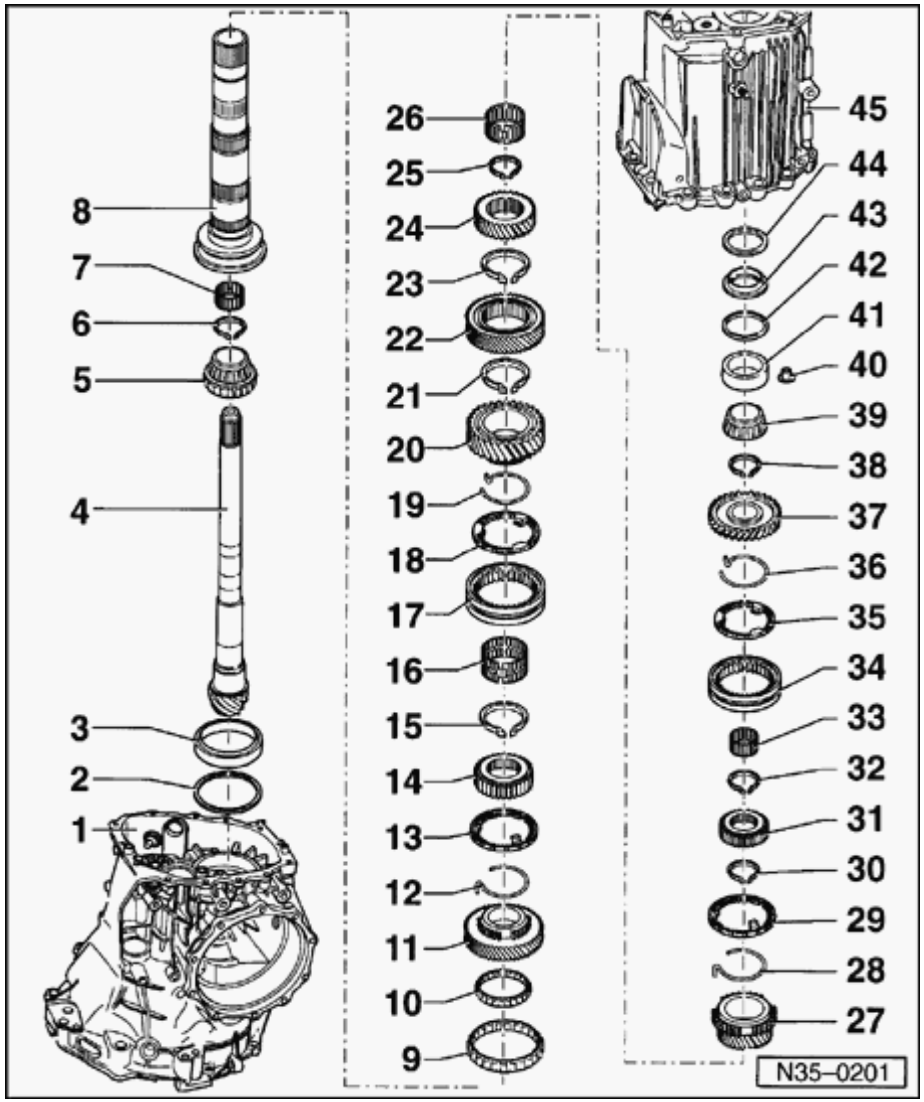
3 - Double tapered roller bearing outer race1)

- Replace together with item - 5 -
- Pulling out ⇒ Fig. 1
- Pressing in ⇒ Fig. 3

4 - Drive pinion

- Matched to ring gear, always replace together as a set
- Adjusting drive pinion and ring gear ⇒ Page 39-34

35-24



5 - Double tapered roller bearing inner race1)

- Always replace
- Damaged when removed
- Pressing off ⇒ Fig. 2
- Pressing on ⇒ Fig. 4

6 - Circlip

- Re-determine thickness if double roller bearing is replaced ⇒ Fig. 5

7 - Needle bearing for hollow shaft1)

- For drive pinion in hollow shaft
- Lubricate with MOS2 grease

8 - Hollow shaft1)

9 - Needle bearing for 1st gear

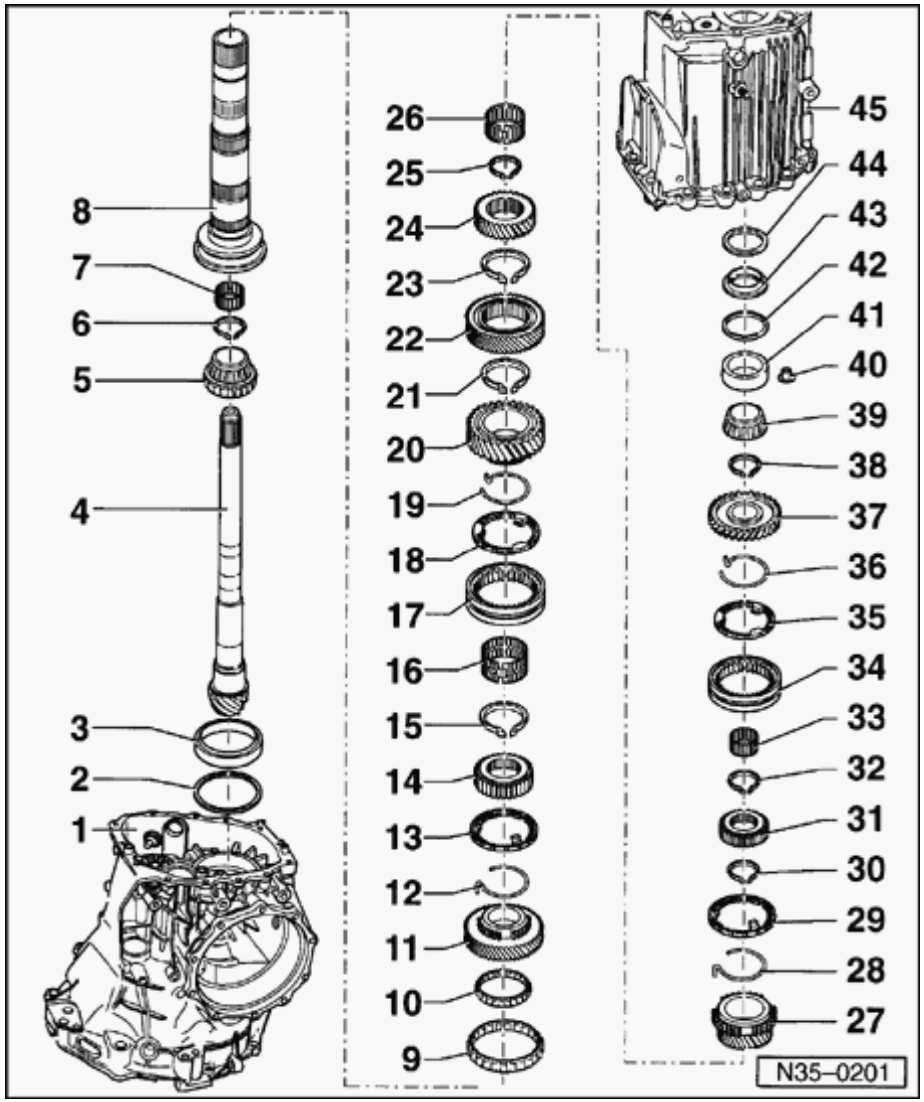
10 - Needle bearing for 1st gear

11 - 1st gear

12 - Spring

- Inserting in 1st gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

35-25



13 - Synchronizer ring for 1st gear

- Checking for wear ⇒ Fig. 17

14 - Synchronizer hub for 1st and 2nd gear

- Pressing off ⇒ Fig. 14
- Pressing on ⇒ Fig. 18

15 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -1-
- Re-determining thickness if synchronizer hub is replaced ⇒ Fig. 5

16 - Needle bearing for 2nd gear

17 - Operating sleeve for 1st and 2nd gear

- Allocation ⇒ Fig. 19

18 - Synchronizer ring for 2nd gear

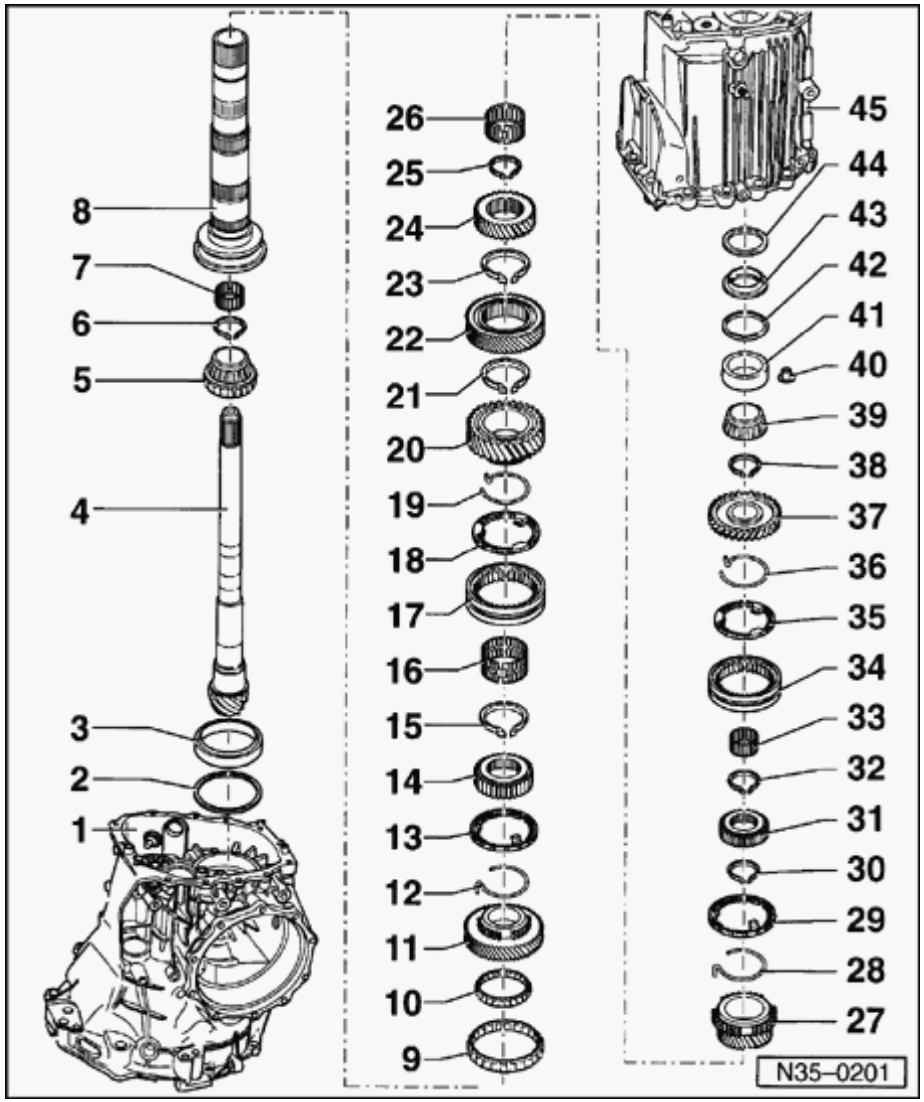
- Checking for wear ⇒ Fig. 17

19 - Spring

- Inserting in 2nd gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

20 - 2nd gear

35-26



21 - Circlip

- Identification
- Allocation ⇒ Fig. 15 item -2-

22 - 3rd gear

- Pressing off ⇒ Fig. 13
- Pressing on ⇒ Fig. 20

23 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -3-
- Re-determining thickness if 3rd gear is replaced ⇒ Fig. 5

24 - 4th gear

- Pressing off ⇒ Fig. 12
- Pressing on ⇒ Fig. 21

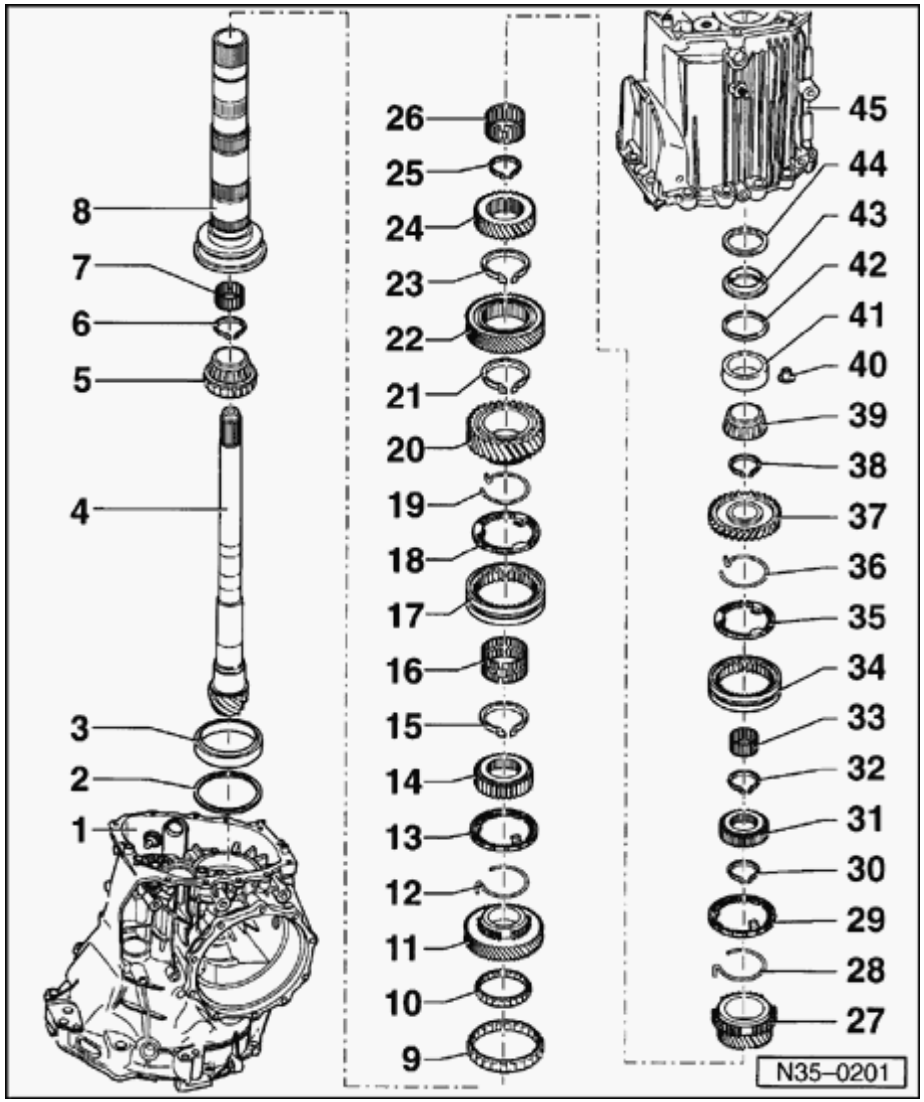
25 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -4-
- Re-determining thickness if 4th gear is replaced ⇒ Fig. 5

26 - Needle bearing

27 - 5th gear

35-27



28 - Spring

- Inserting in 5th gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

29 - Synchronizer ring for 5th gear

- Checking for wear ⇒ Fig. 17

30 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -5-

31 - Synchronizer hub for 5th gear and reverse gear

- Pressing off ⇒ Fig. 11
- Pressing on ⇒ Fig. 22

32 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -6-
- Re-determining thickness if synchronizer hub is replaced ⇒ Fig. 5

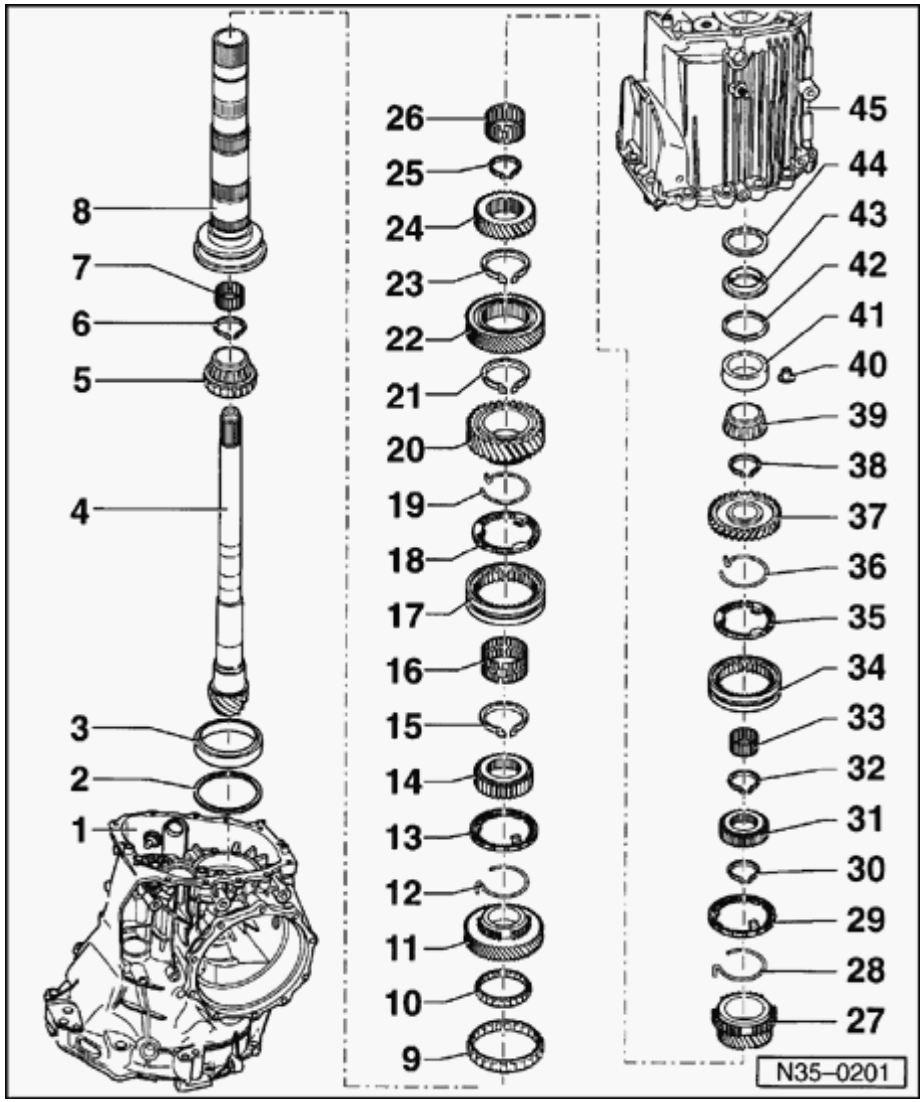
33 - Needle bearing

- For reverse gear

34 - 5th and reverse gear operating sleeve

- Allocation ⇒ Fig. 23

35-28



35 - Synchronizer ring for reverse gear

- Checking for wear ⇒ Fig. 17

36 - Spring

- Insert in reverse gear ⇒ Fig. 16
- Application of spring to gear ⇒ Parts catalog

37 - Reverse gear

38 - Circlip

- Identification
- Allocation ⇒ Fig. 15 , item -7-

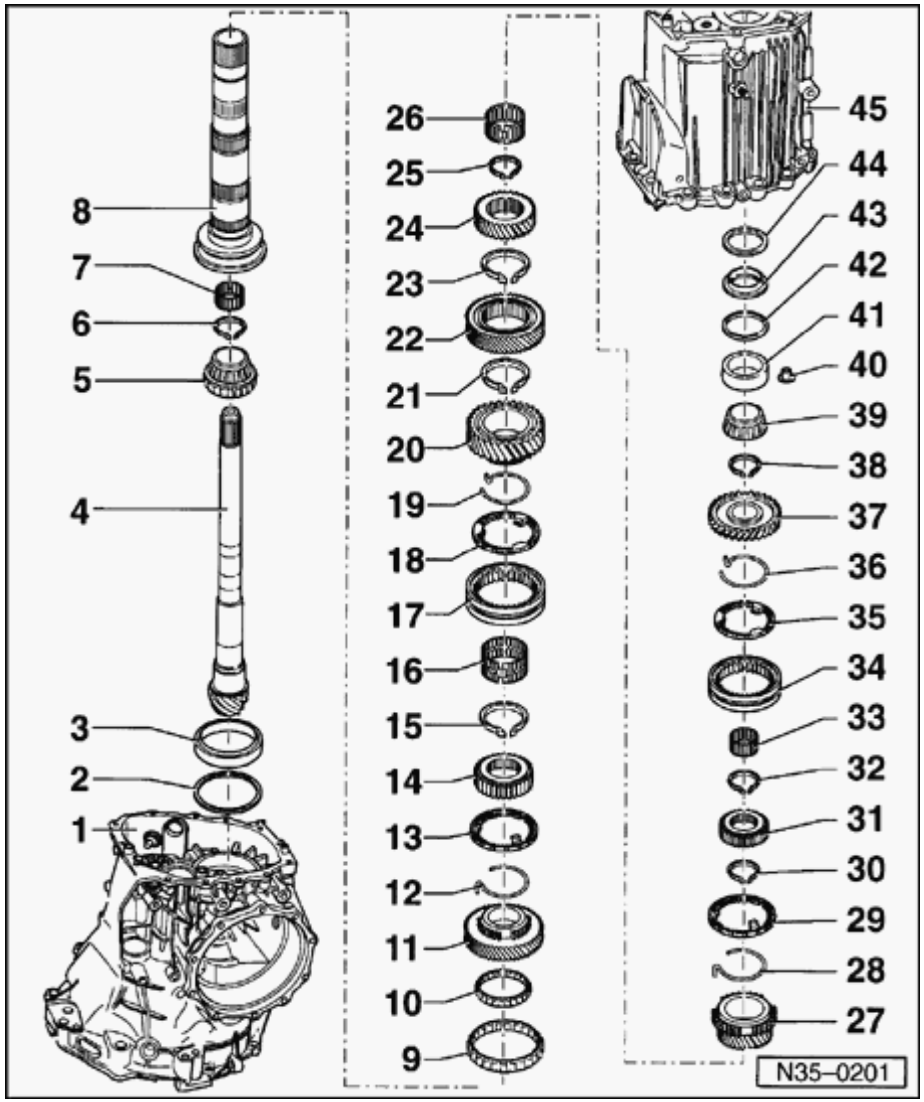
39 - Tapered roller bearing inner race1)

- Pressing off ⇒ Fig. 9
- Pressing on ⇒ Fig. 10

40 - Bushing

- To secure small tapered roller bearing outer race
- Pulling out ⇒ Fig. 6
- Does not need to be installed after small tapered roller bearing has been replaced

35-29



41 - Tapered roller bearing outer race1)

- Pressing out ⇒ Fig. 7
- Pressing in ⇒ Fig. 8

42 - Shim S4

- List of adjustments ⇒ Page 39-37

43 - Ring

- Holds rubber washer
- Application ⇒ Parts catalog

44 - Rubber washer

- Compensates length variations
- Application ⇒ Parts catalog

45 - Transmission cover

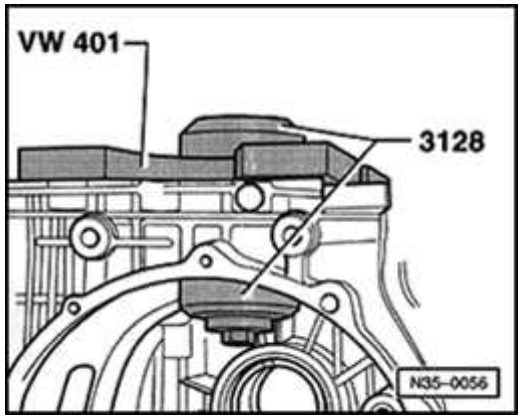


Fig. 1 Pulling out double tapered roller bearing outer race

- Remove differential ⇒ Page 39-16 .
- Place pressure piece of 3128 bushing puller below outer race.
- Install threaded part of 3128 bushing puller using VW401 thrust plate onto transmission housing.

When the bolt is tightened, the outer race will be pulled out of the housing.

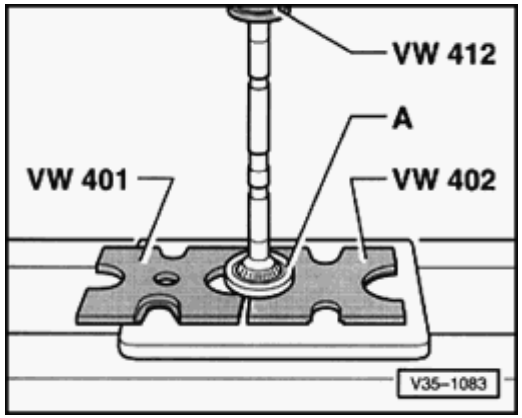


Fig. 2 Pressing off double tapered roller bearing inner race

- Remove circlip before pressing off.
- Outer race -A- must be installed to press off inner race.

Note:

When pressing off, the inner ring of the double tapered roller bearing is damaged.

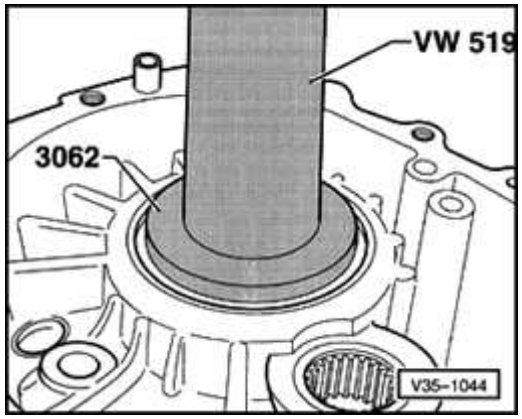


Fig. 3 Pressing in double tapered roller bearing outer race

The smaller diameter of 3062 thrust pad faces outer race.

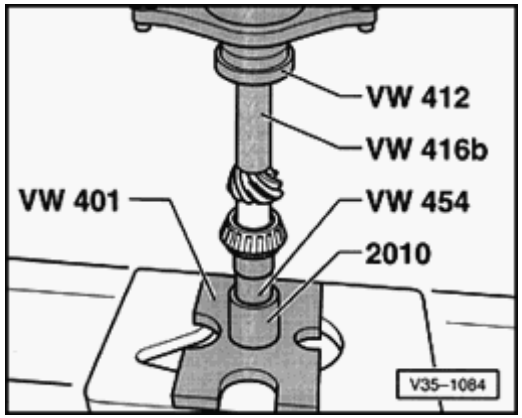


Fig. 4 Pressing on double tapered roller bearing inner race

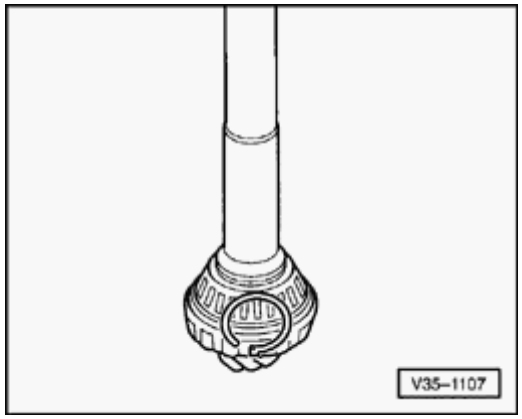


Fig. 5 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Circlips for synchronizer hubs, needle bearings and individual gears should be determined as for double tapered roller bearing shown.

  Available circlips and part numbers ⇒ Parts catalog

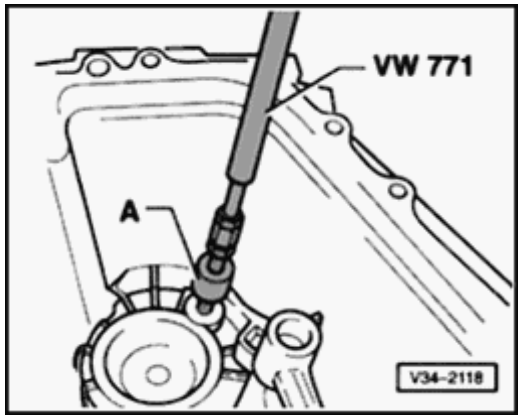


Fig. 6 Pulling out securing bushing for small tapered roller bearing outer race

A - Puller 12-14.5 mm (0.472-0.570 in.), e.g. Kukko 21/1 puller

35-33

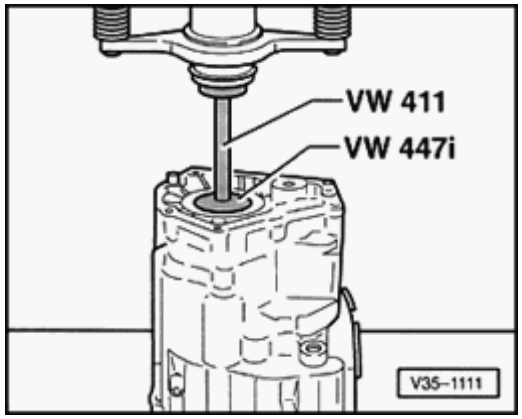


Fig. 7 Pressing out tapered roller bearing outer race

The outer race is pressed out together with pressure plate (item - 43 -), ⇒ Page 35-29 , shim S4 (item -42-) ⇒ Page 35-29 and the rubber washer for compensating length variations (item 44), ⇒ Page 35-29 .

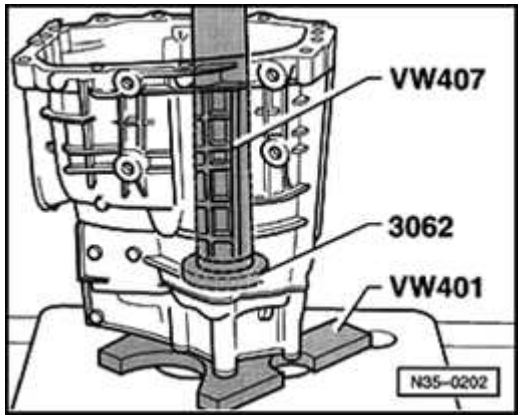


Fig. 8 Pressing in tapered roller bearing outer race

35-34

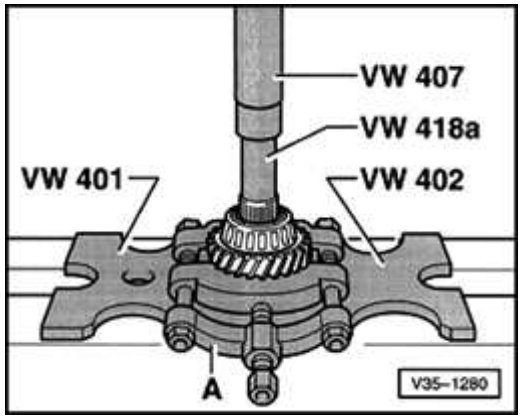


Fig. 9 Pressing off tapered roller bearing inner race

- Press off inner race together with reverse gear.

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

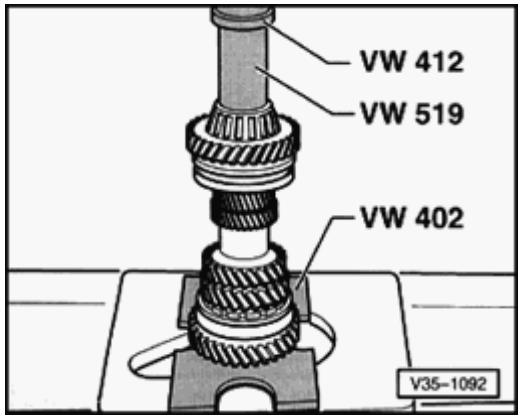


Fig. 10 Pressing on tapered roller bearing inner race

- Install circlip before pressing on inner race.

35-35

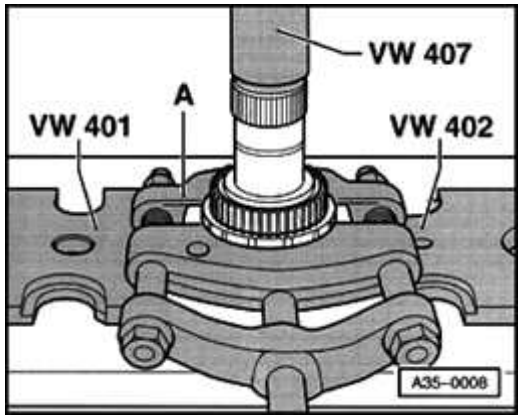


Fig. 11 Pressing off synchronizer hub for 5th gear and reverse idler gear

- Remove circlip before pressing off.
- Press off synchronizer hub together with 5th gear.

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

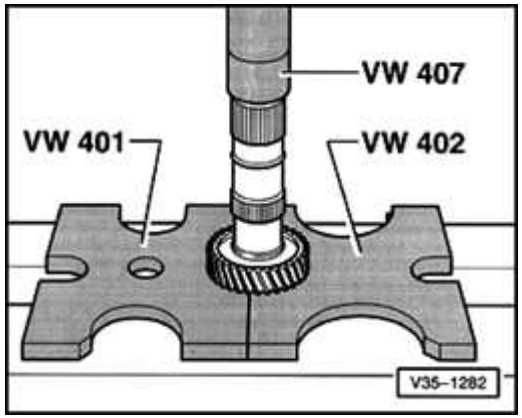


Fig. 12 Pressing off 4th gear

- Remove circlip before pressing off.

35-36

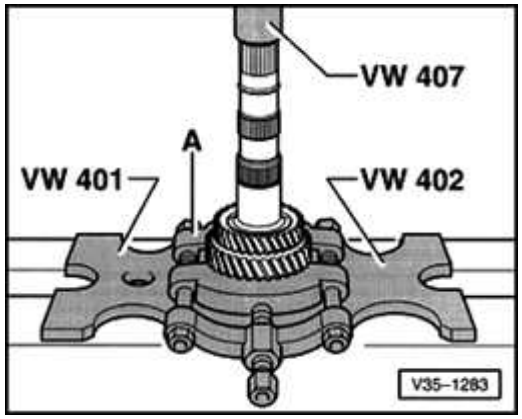


Fig. 13 Pressing off 3rd gear

- Remove circlip before pressing off.
- Press off 3rd gear together with 2nd gear.

A - Separating tool 22-115 mm (0.866-0.590 in.), e.g. Kukko 17/2 separating tool

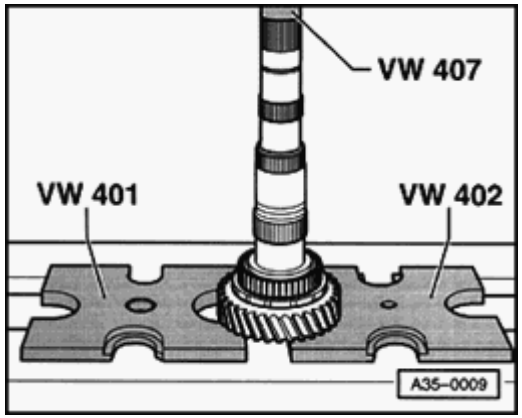


Fig. 14 Pressing off 1st and 2nd gear synchronizer hub

- Remove circlip before pressing off.
- Press off synchronizer hub together with 1st gear.

35-37

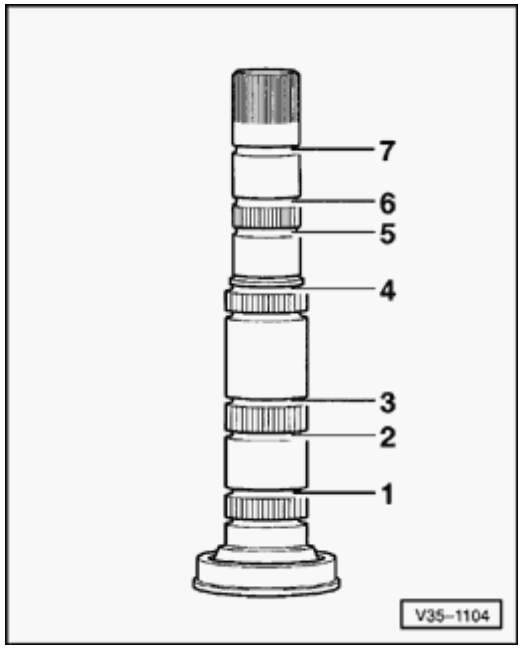


Fig. 15 Allocation of circlips

- Circlips for synchronizer hubs, needle bearings and individual gears should be determined according to Fig. ⇒ 5 .

Circlip 1- secures the 1st and 2nd gear synchronizer hub

Identification: color blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

Circlip 2- secures the needle bearing/ 2nd gear

Thickness: 2.00 mm (0.078 in.). Identification: color blue

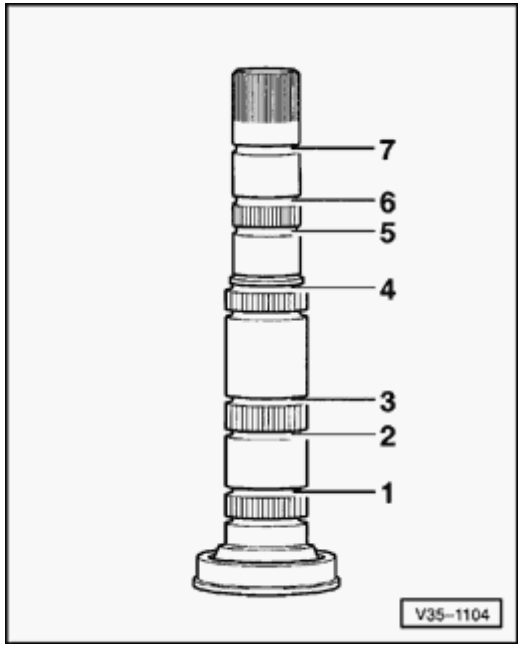
Circlip 3- secures the 3rd gear

Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	

35-38

Circlip -4- secures the 4th gear.

Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	



Circlip -5- secures the needle bearing/ 5th gear

Thickness 2.00 mm (0.078 in.)

Identification: color brown

Circlip -6- secures the synchronizer hub for 5th and reverse gear

Identification: color blue

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

Circlip -7- secures needle bearing for reverse gear

Thickness 2.50 mm (0.098 in.)

- Determine circlips according to table. Part number ⇒ parts catalog

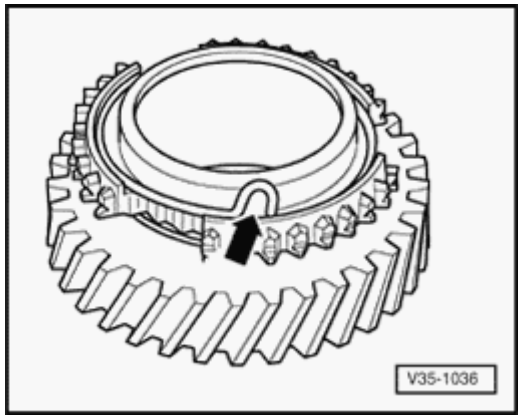


Fig. 16 Inserting spring in gear

The bent end of the spring (arrow) must be hooked into the hole in the gear.

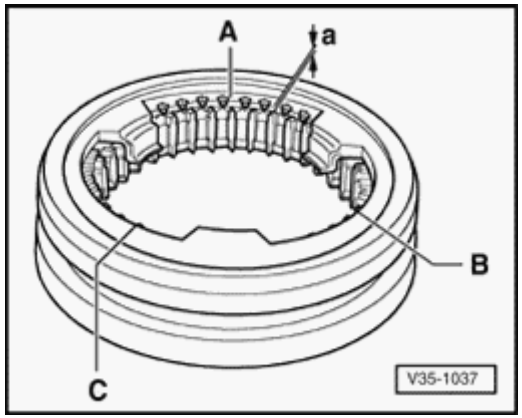


Fig. 17 Checking synchronizer ring for wear

- Press synchronizer-ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add calculated measurements and divide by 3.

The average gap must not be less than 0.5 mm (0.019 in.).

35-40

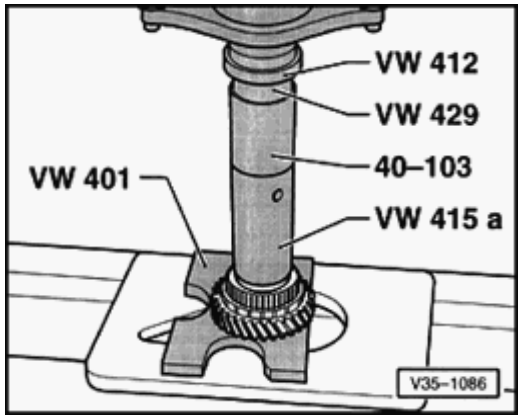


Fig. 18 Pressing on 1st and 2nd gear synchronizer hub

Allocation: higher inner collar faces 2nd gear.

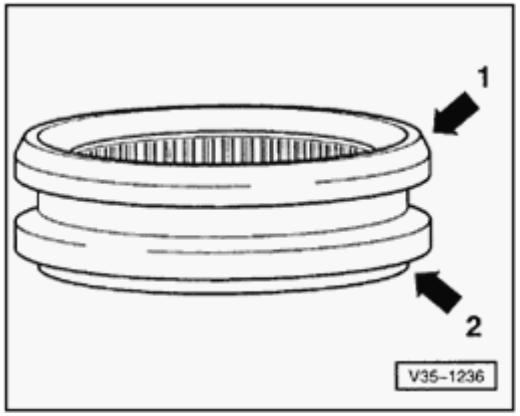


Fig. 19 Allocation of 1st and 2nd gear operating sleeve

- Chamfer (arrow -1-) faces 2nd gear.
- Stepped side (arrow -2-) faces 1st gear.

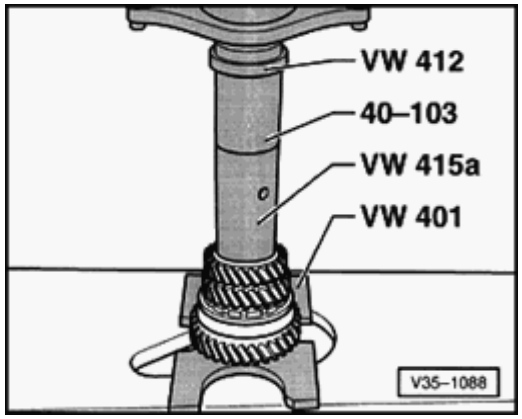


Fig. 20 Pressing on 3rd gear

Allocation: the groove on the gear faces 4th gear.

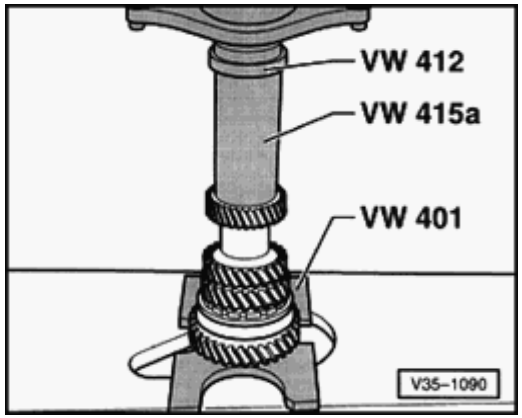


Fig. 21 Pressing on 4th gear

Allocation: higher inner collar faces 3rd gear.

35-42

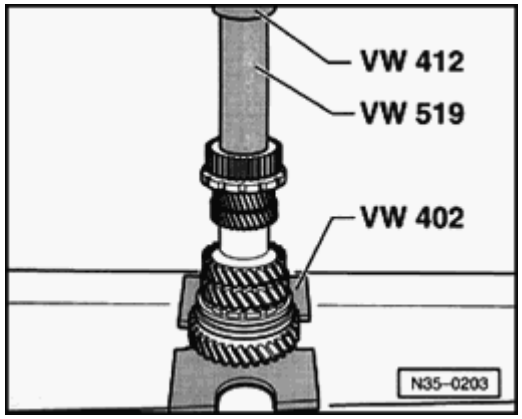


Fig. 22 Pressing on 5th and reverse gear synchronizer hub

Allocation: higher inner collar faces 5th gear.

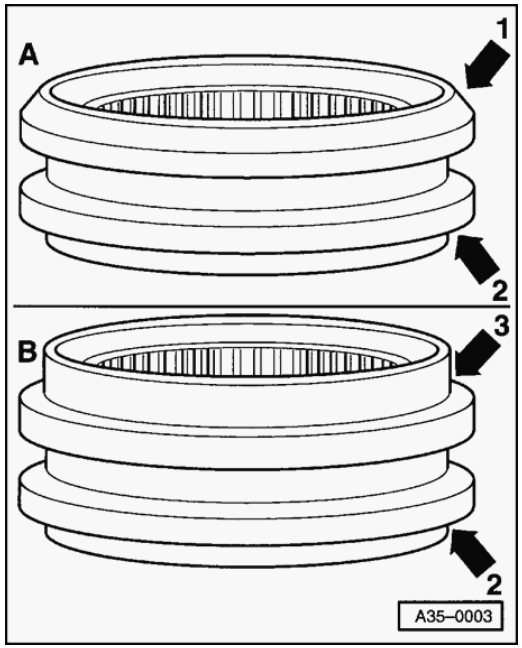


Fig. 23 Allocation of operating sleeve for 5th and reverse gears

Operating sleeves with chamfer -A- as well as operating sleeves with large offset -B- are installed.

Note the location of operating sleeve to reverse idler gear ⇒ Fig. 24 .

Allocation:

- Chamfer (arrow -1-) faces reverse idler gear
- Smaller offset (arrow -2-) faces 5th gear
- Larger offset (arrow -3-) faces reverse idler gear

35-43

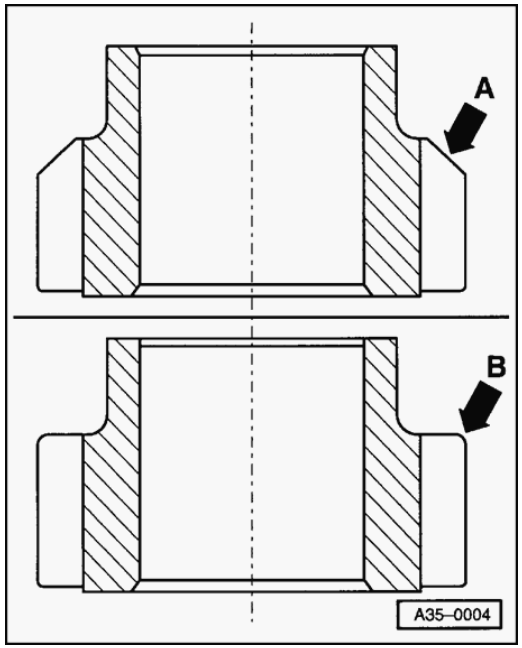


Fig. 24 Allocation of operating sleeve to reverse idler gear

On the reverse idler gear -A- both types of operating sleeves (with chamfer or with large offset) can be installed.

On reverse idler gear -B- without chamfer only operating sleeves with large offset can be installed. Do not install operating sleeves with chamfer.

Pinion shaft, disassembling and assembling

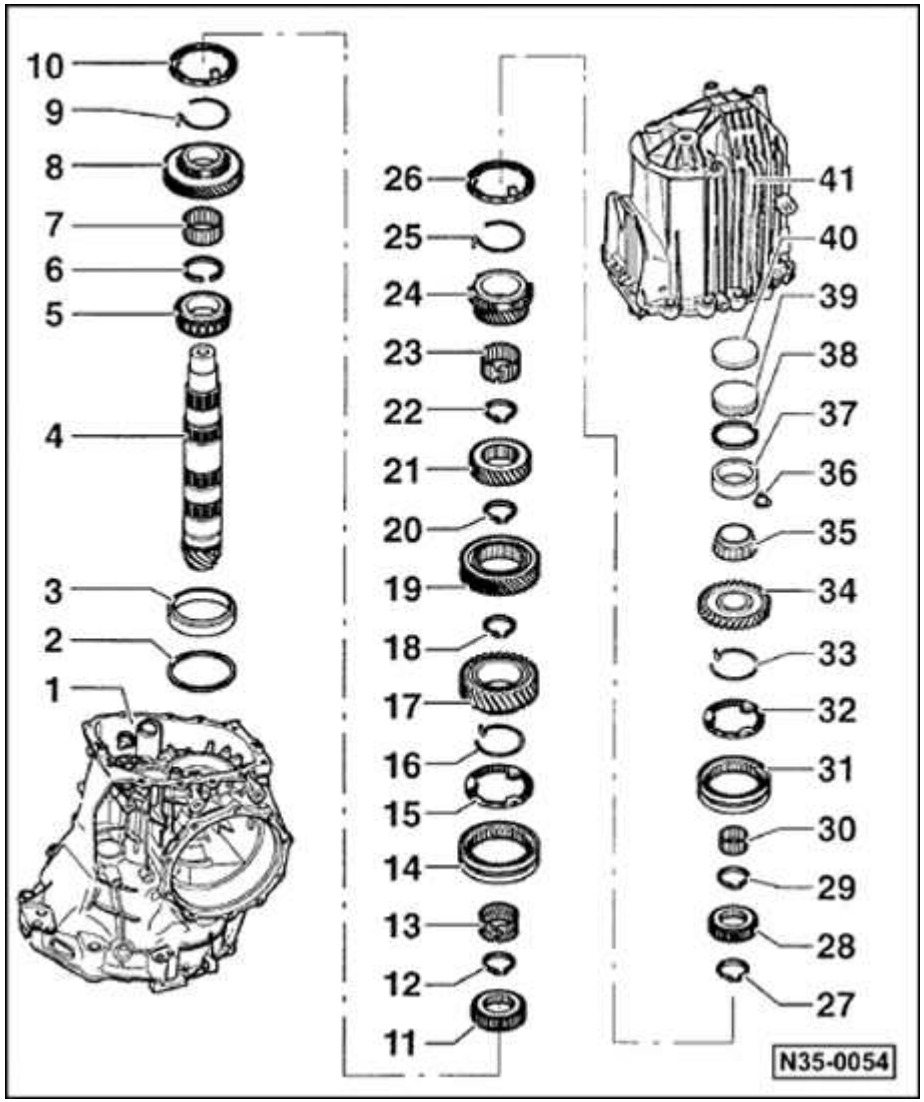
Special tools and equipment

- 204B installation tool for crankshaft seal
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 punch
- VW415A tube
- VW421 tube
- VW455 thrust tube
- VW519 sleeve

- VW771 slide hammer-complete set

- 2010 sleeve
- 3062 thrust pad
- 3118 sleeve
- 3128 bushing puller
- Kukko 17/2 separating tool
- Kukko 21/1 extractor

35-23



Notes:

- *When installing the input shaft or the final drive set, consult technical data ⇒ Page 00-3 .*
- *Adjustments are required when replacing components marked with 1): ⇒ Page 39-33 , list of adjustments*

1 - Transmission housing

2 - Shim S3

- List of adjustments ⇒ Page 39-33

3 - Double tapered roller bearing outer race 1)

- Pulling out ⇒ Fig. 1
- Pressing in ⇒ Fig. 3

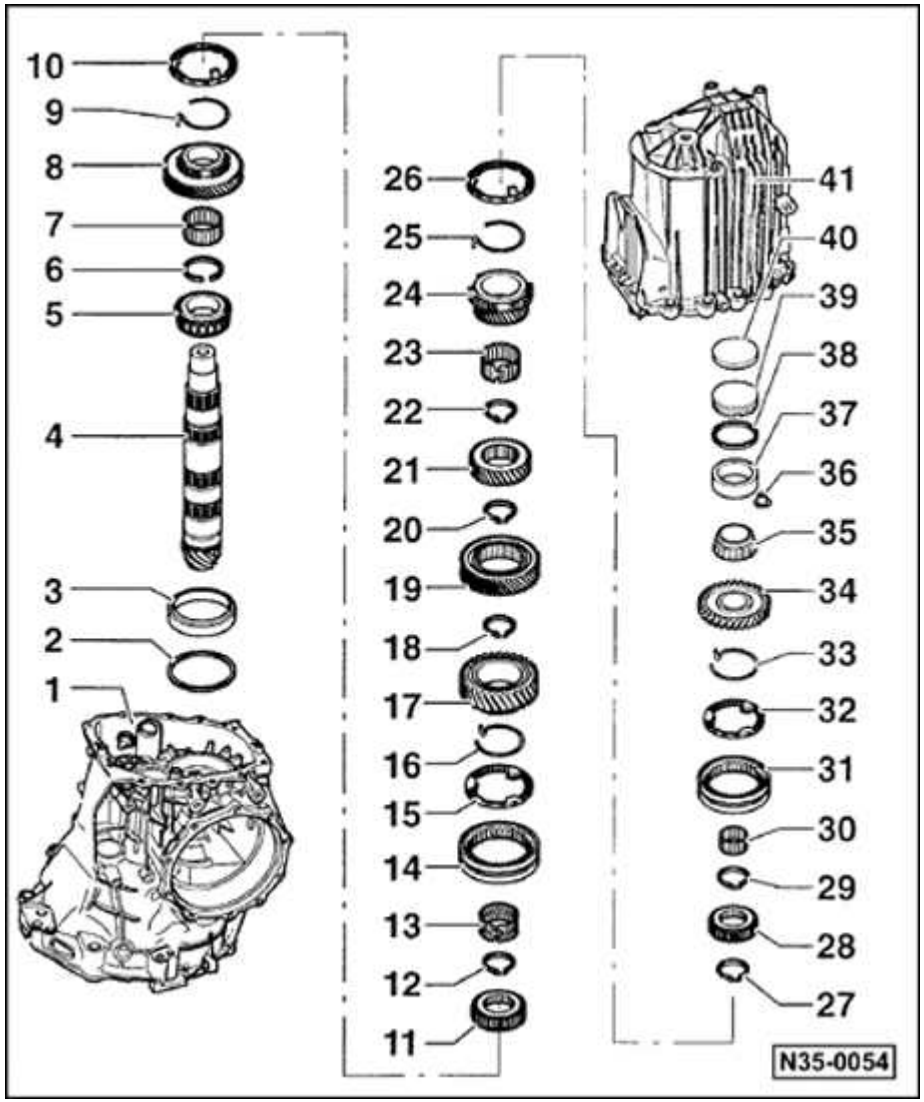
4 - Pinion shaft 1)

- Matched to ring gear; always replace together as a set
- Adjusting pinion shaft and ring gear ⇒ Page 39-29

5 - Tapered roller bearing inner race1)

- Always replace
- Damaged when removed
- Pressing off ⇒ Fig. 2
- Pressing on ⇒ Fig. 4

35-24



6 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -1-
- Re-determine thickness if double roller bearing is replaced ⇒ Fig. 5

7 - Needle bearing for for 1st gear

8 - 1st gear

9 - Spring

- Inserting in 1st gear ⇒ Fig. 16
- Allocation of spring to gear ⇒ parts catalog

10 - Synchronizer ring for 1st gear

- Checking for wear ⇒ Fig. 17

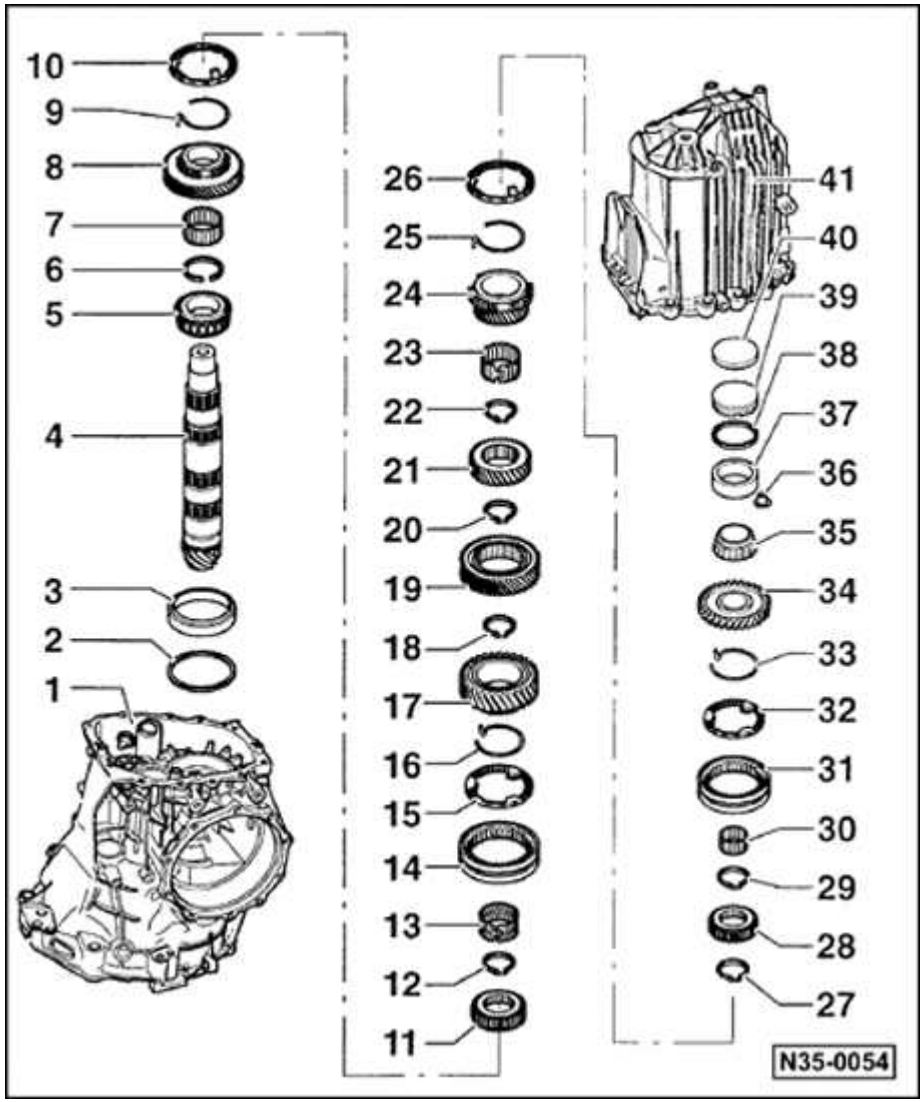
11 - Synchronizer hub for 1st and 2nd gears

- Pressing off ⇒ Fig. 14
- Pressing on ⇒ Fig. 18

12 - Circlip

- Identification
- Installed position Fig. , item -2-
- Re-determine thickness when replacing synchronizer body ⇒ Fig. 5

35-25



13 - Needle bearing 2nd gear

14 - Operating sleeve for 1st and 2nd gear

- Installed position ⇒ Fig. 19

15 - Synchronizer ring for 2nd gear

- Checking for wear ⇒ Fig. 17

16 - Spring

- Inserting in 2nd gear ⇒ Fig. 16
- Allocation of spring to gear ⇒ parts catalog

17 - 2nd gear

18 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -3-

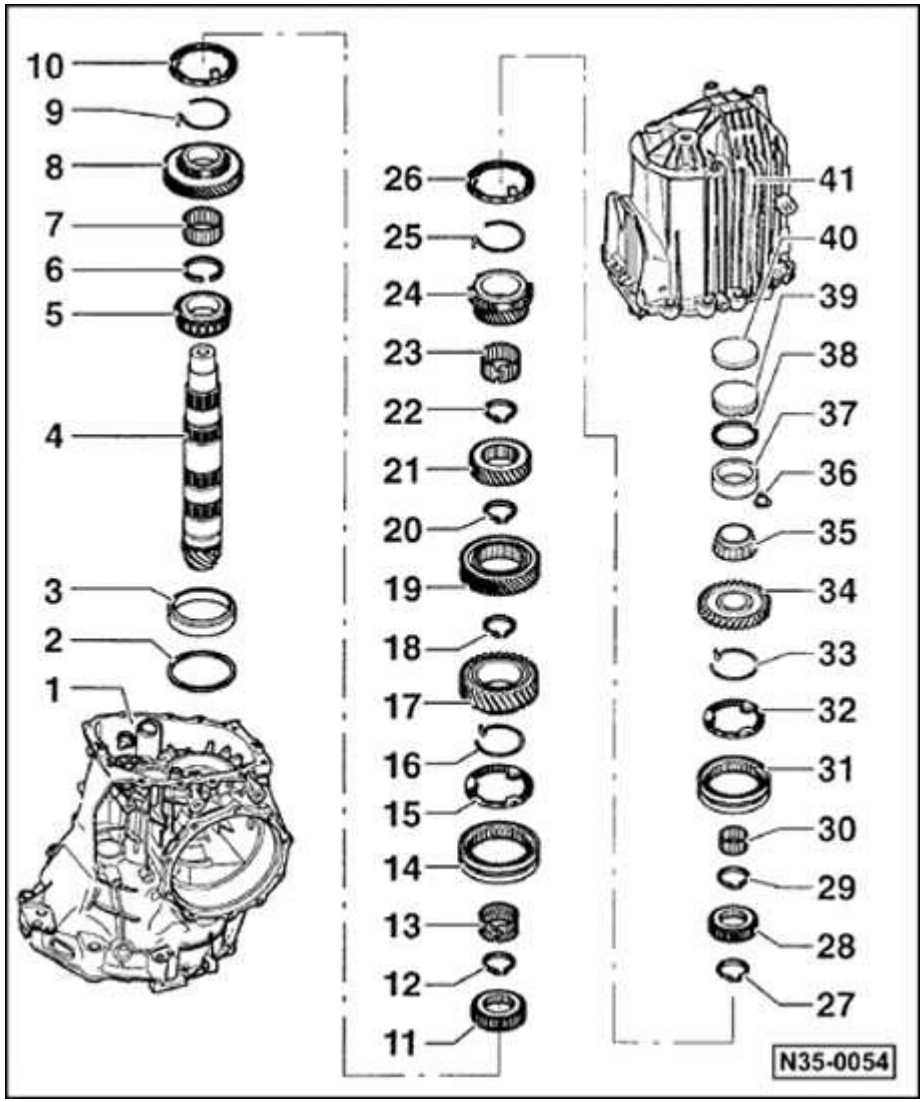
19 - 3rd gear

- Pressing off ⇒ Fig. 13
- Pressing on ⇒ Fig. 20

20 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -4-
- If 3rd gear is replaced, re-determine thickness of circlip ⇒ Fig. 5

35-26



21 - 4th gear

- Pressing off ⇒ Fig. 12
- Pressing on ⇒ Fig. 21

22 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -5-
- If 4th gear is replaced, re-determine thickness of circlip ⇒ Fig. 5

23 - Needle bearing

24 - 5th gear

25 - Spring

- Inserting in 5th gear ⇒ Fig. 16
- Allocation of spring to gear ⇒ parts catalog

26 - Synchronizer ring for 5th gear

- Checking for wear ⇒ Fig. 17

27 - Circlip

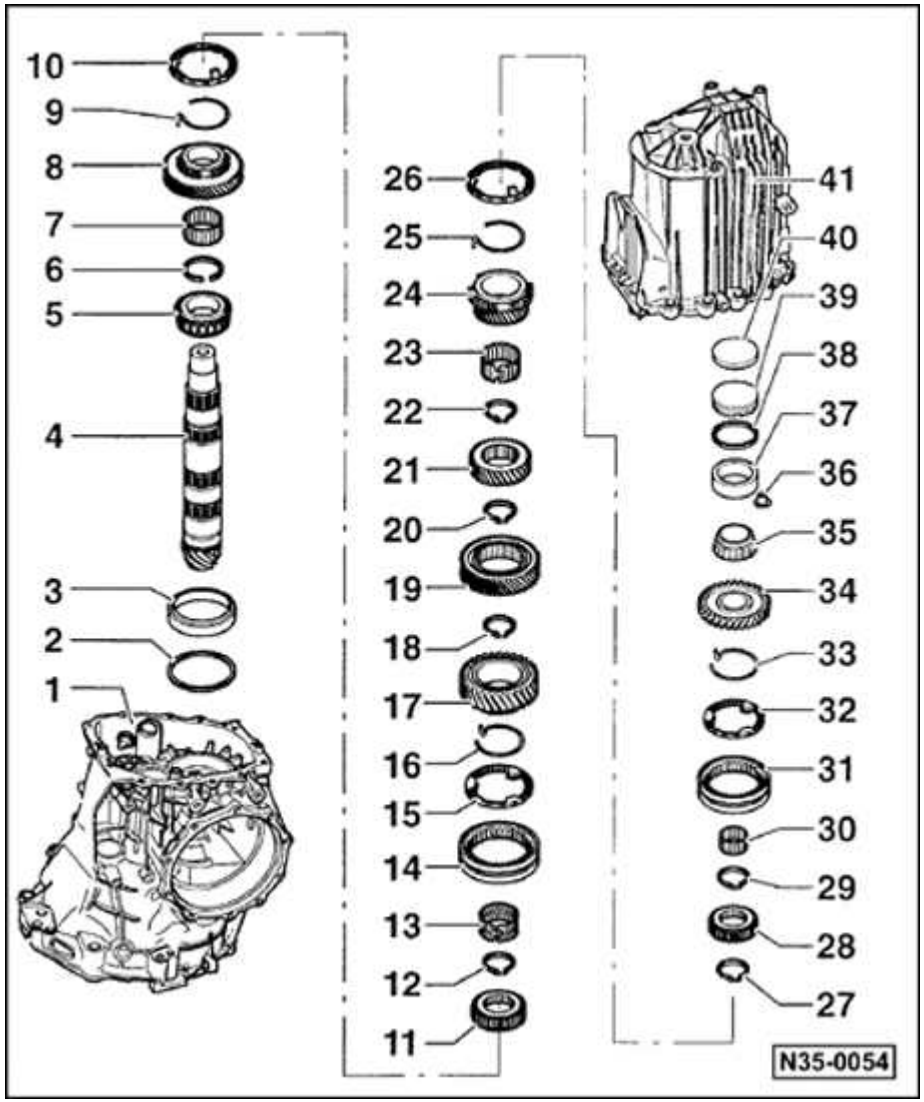
- Identification
- Installed position ⇒ Fig. 15 , item -6-

28 - Synchronizer hub for 5th and reverse gear

- Pressing off ⇒ Fig. 11

♦ Pressing on ⇒ Fig. 22

35-27



29 - Circlip

- Identification
- Installed position ⇒ Fig. 15 , item -5-
- Re-determine thickness when replacing synchronizer hub ⇒ Fig. 5

30 - Needle bearing

- For reverse gear

31 - Operating sleeve for 5th and reverse gear

- Installed position ⇒ Fig. 23

32 - Synchronizer ring for reverse gear

- Checking for wear ⇒ Fig. 17

33 - Spring

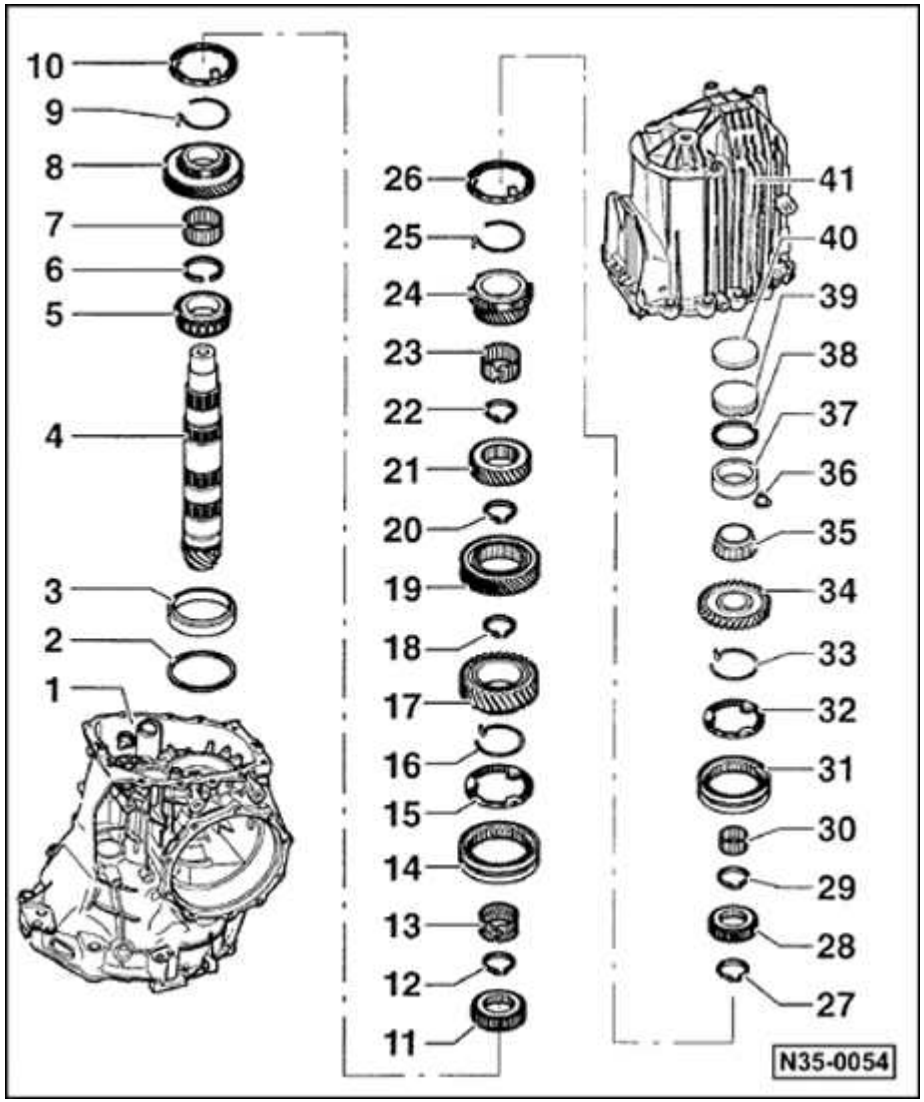
- Inserting in reverse gear ⇒ Fig. 16
- Allocation of spring to gear ⇒ parts catalog

34 - Reverse gear

35 - Tapered roller bearing inner race1)

- Pressing off ⇒ Fig. 9
- Pressing on ⇒ Fig. 10

35-28



36 - Bushing

- Secures tapered roller bearing inner race
- Pulling out ⇒ Fig. 6
- Does not need to be installed after tapered roller bearing has been replaced

37 - Tapered roller bearing outer race1)

- Pulling out ⇒ Fig. 7
- Pressing in ⇒ Fig. 8

38 - Shim S4

- List of adjustments ⇒ Page 39-33

39 - Pressure plate

- Varying thickness ⇒ Fig. 25

40 - Rubber washer

- Compensated length variations
- To remove, install self-tapping screw into center of rubber washer and pull out at screw
- Thickness: 7.0 mm (0.28 in.)

41 - Transmission cover

- With reverse idler gear ⇒ Page 35-44
- Coat sealing surfaces with thin layer of

sealant AMV 188 001 02

35-29

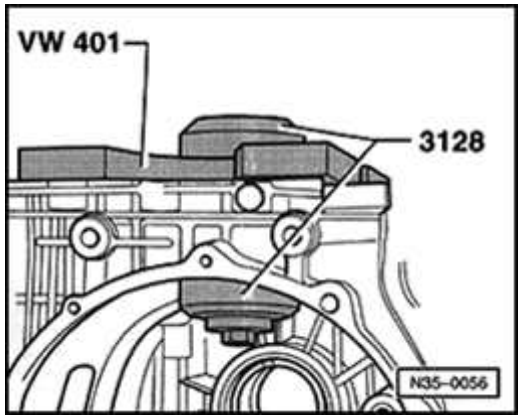


Fig. 1 Pulling out double tapered roller bearing outer race

- Remove differential ⇒ Page 39-10 .
- Place pressure piece from 3128 bushing puller under outer race.
- Install threaded part of 3128 bushing puller onto transmission housing using VW401 thrust plate.

When the bolt is tightened, the outer race will be pulled out of the housing.

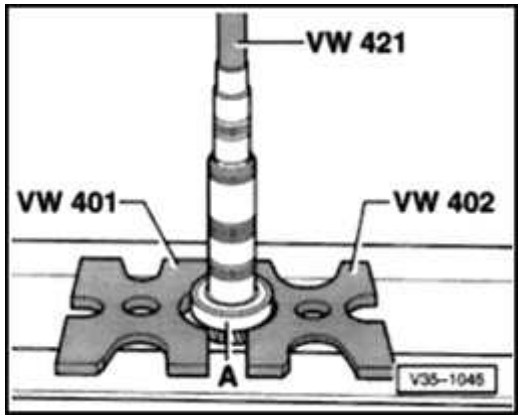


Fig. 2 Pressing off double tapered roller bearing inner race

- Remove circlip before pressing off.

  Outer race -A- must be installed to press off inner race.

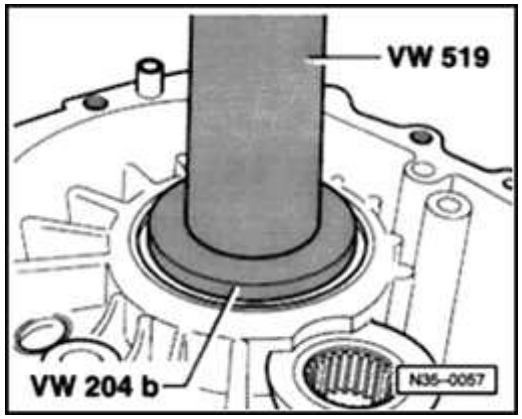


Fig. 3 Pressing in double tapered roller bearing outer race

The smaller diameter of the VW204B arbor faces the outer race.

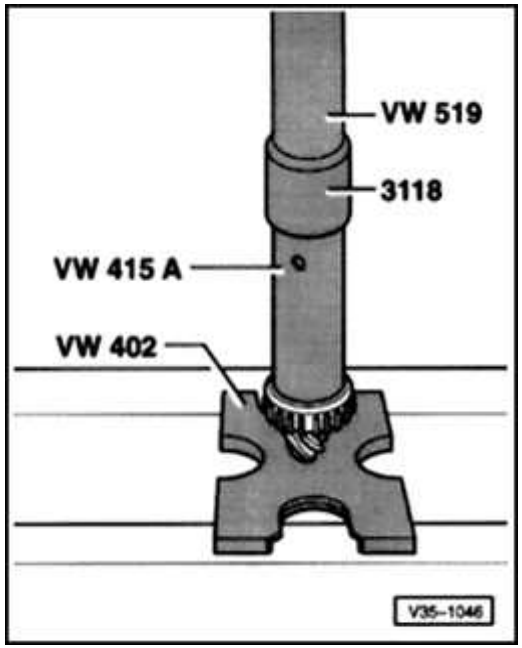


Fig. 4 Pressing on double tapered roller bearing inner race

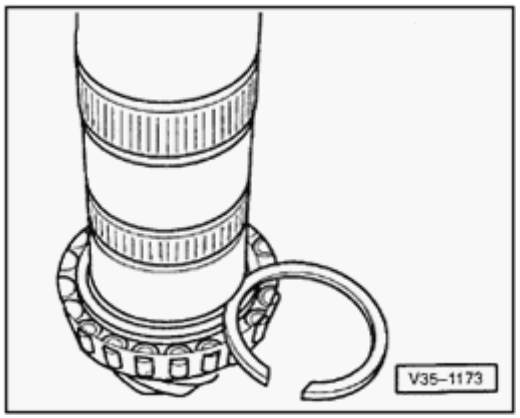


Fig. 5 Determining thickness of circlip

- Determine thickest circlip which can still just be installed and install it.
- Circlips for synchronizer hubs and individual gears should be determined using same method as for tapered roller bearing as shown.

  Available circlips and part numbers ⇒ parts catalog

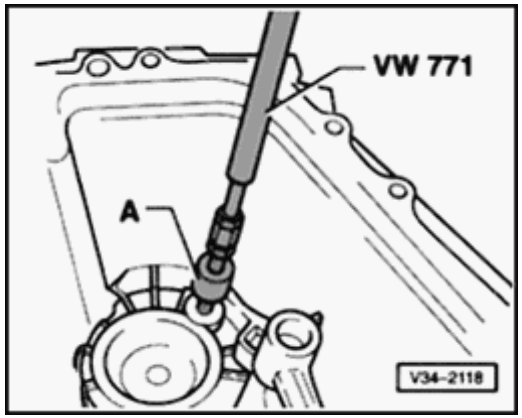


Fig. 6 Pulling out bushing securing tapered roller bearing outer race

A - Kukko 21/1 extractor 12-14.5 mm

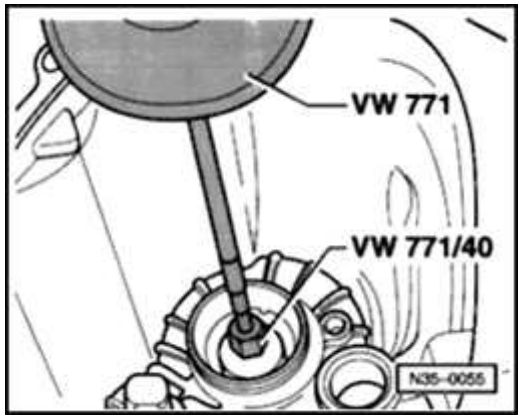


Fig. 7 Pulling out tapered roller bearing outer race

- Install VW771/40 adaptor into pressure plate.
- Install VW771 slide hammer-complete set and pull out outer race over pressure plate.

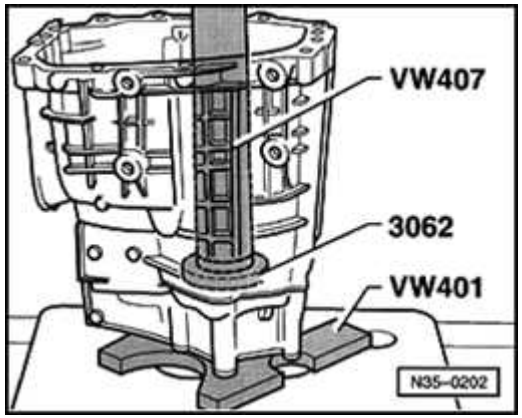


Fig. 8 Pressing in tapered roller bearing outer race

- Before pressing on inner race, install circlip.

35-33

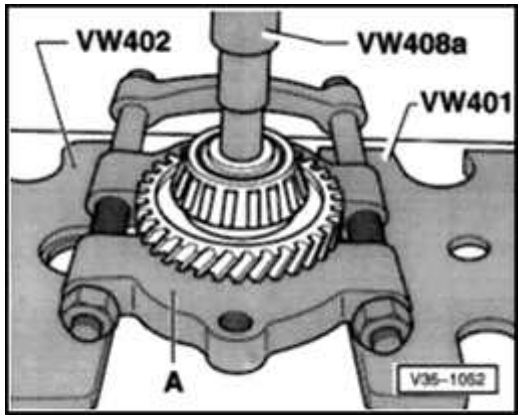


Fig. 9 Pressing off tapered roller bearing inner race

- Press off inner race together with reverse gear.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

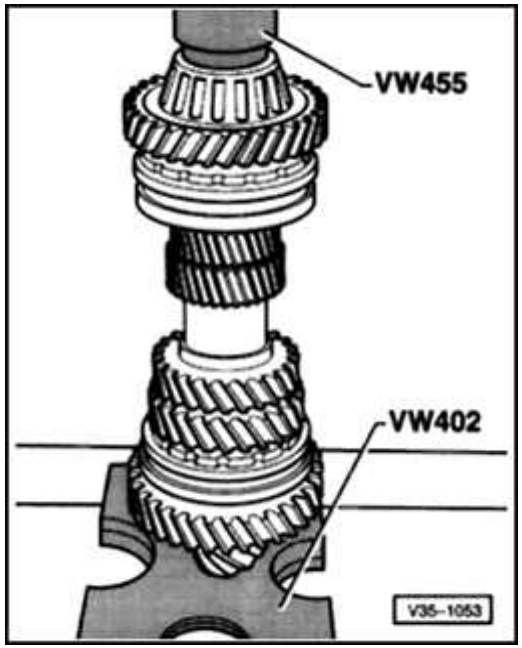


Fig. 10 Pressing on tapered roller bearing inner race

- Before pressing on inner race, install circlip.

35-34

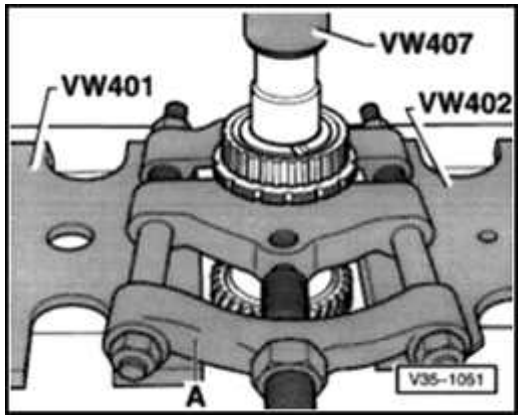


Fig. 11 Pressing off synchronizer hub for 5th and reverse gear

- Remove circlip before pressing off.
- Press off synchronizer hub together with 5th gear.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

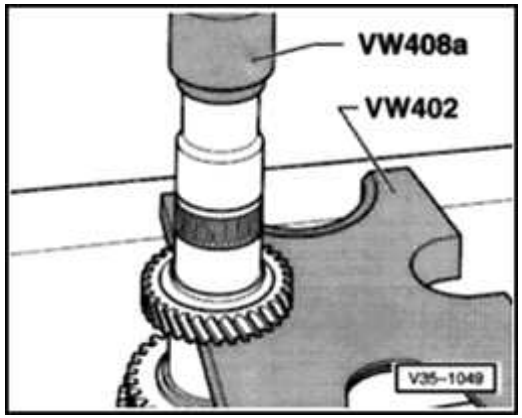


Fig. 12 Pressing off 4th gear

- Remove circlip before pressing off.

35-35

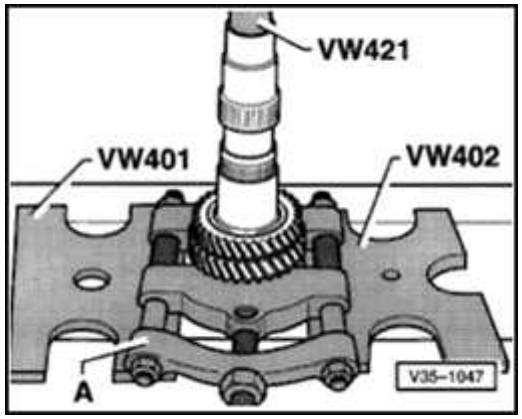


Fig. 13 Pressing off 3rd gear

- Remove circlip before pressing off.
- Press off 3rd gear together with 2nd gear.

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

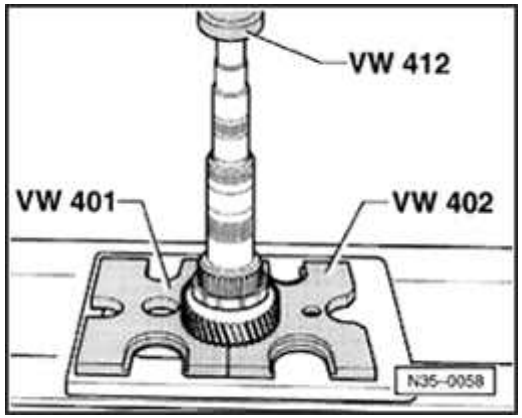


Fig. 14 Pressing off synchronizer hub for 1st and 2nd gears

- Remove circlip before pressing off.
- Press off synchronizer hub together with 1st gear.

35-36

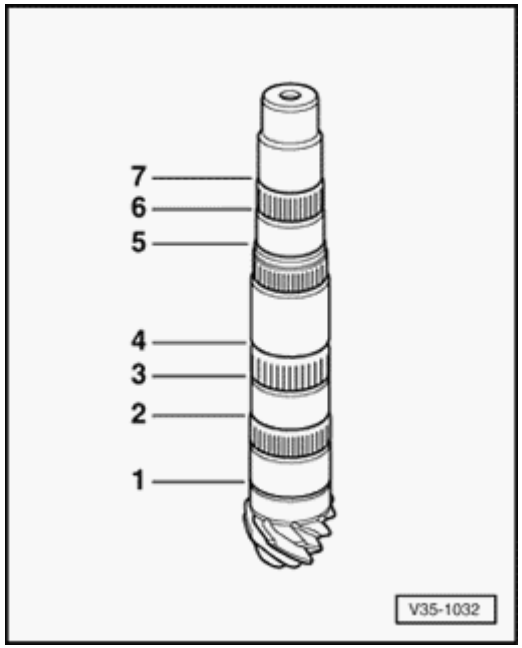


Fig. 15 Installation position of circlips

- Circlips for synchronizer hubs, needle bearings and individual gears should be determined as shown in Fig. ⇒ 5 .

♦ Circlip -1- secures the tapered roller bearing inner race.

Circlip thickness (mm)		
2.00	2.06	2.12
2.03	2.09	2.15

♦ Circlip -2- secures the synchronizer hub for 1st and 2nd gear.

Characteristic: blue in color

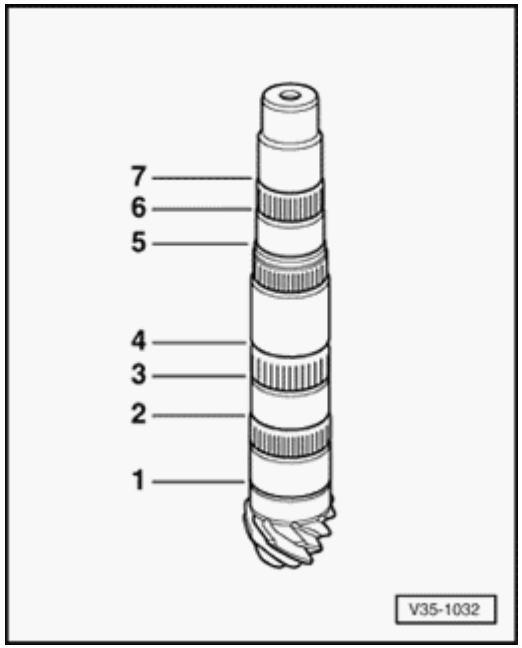
Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	

♦ Circlip -3- secures the needle bearing for 2nd gear.

Characteristic: blue in color

Thickness: 2.50 mm (0.098 in.)

35-37



- Circlip -4- secures the 3rd gear

Circlip thickness (mm)		
1.90	1.98	2.06
1.94	2.02	

- Circlip -5- secures the 4th gear

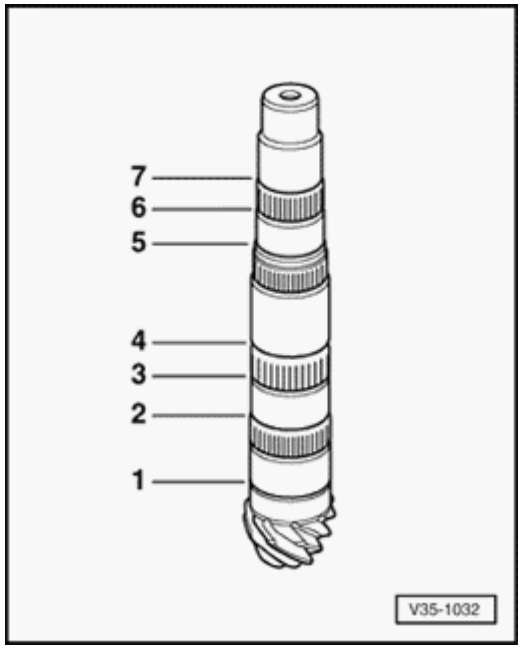
Circlip thickness (mm)		
1.86	1.94	
1.90	1.98	

- Circlip -6- secures the needle bearing for 5th gear.

  Thickness: 2.00 mm (.0787 in.)

  Identification: brown in color

35-38



- Circlip -7- secures the synchronizer hub for 5th and reverse gear.

  Characteristic: blue in color

Circlip thickness (mm)		
1.90	1.96	2.02
1.93	1.99	2.05

- Determine circlips according to table. Part numbers ⇒ parts catalog

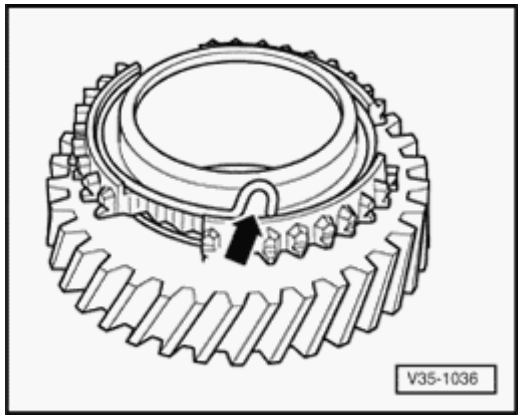


Fig. 16 Inserting spring into gear

The bent end of the spring (arrow) must be hooked into the hole of the gear.

35-39

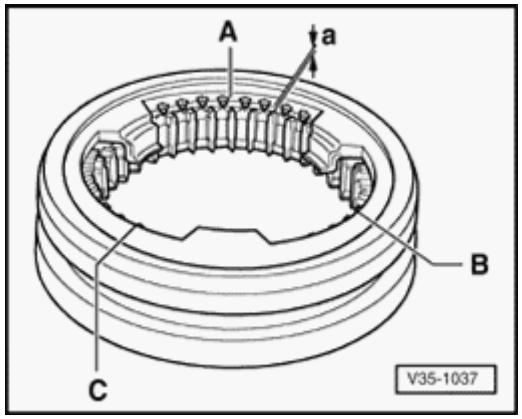


Fig. 17 Checking synchronizer ring for wear

- Press synchronizer ring into operating sleeve and measure gap -a- using feeler gauge at positions -A-, -B- and -C-.
- Add measured values and divide total by three to calculate average.

  The calculated gap must not be less than 0.5 mm (0.002 in.).

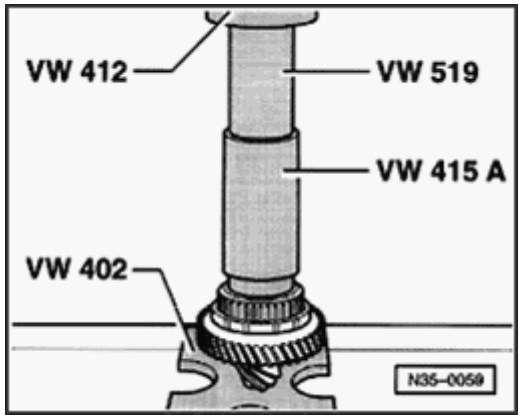


Fig. 18 Pressing on synchronizer hub for 1st and 2nd gears

- Installation position:

  Higher inner collar faces 2nd gear.

35-40

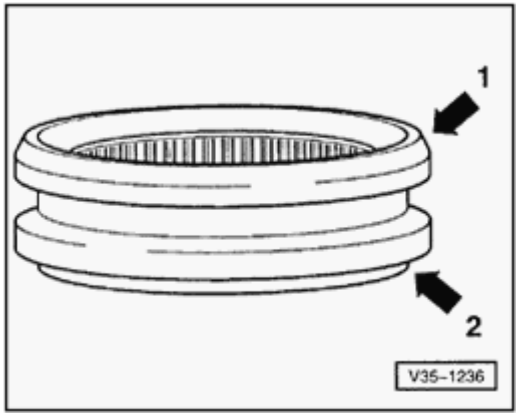


Fig. 19 Installation position of operating sleeve for 1st and 2nd gear

Installation position:

- Chamfer (arrow -1-) faces 2nd gear
- Stepped side (arrow -2-) faces 1st gear

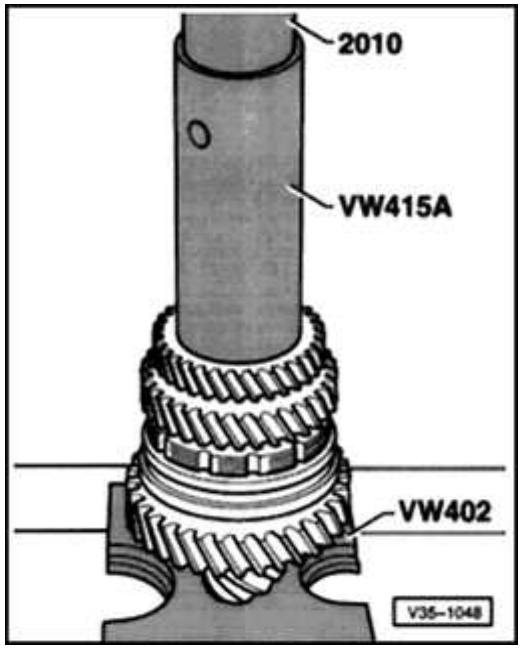


Fig. 20 Pressing on 3rd gear

Installation position: the groove on the gear faces 4th gear.

35-41

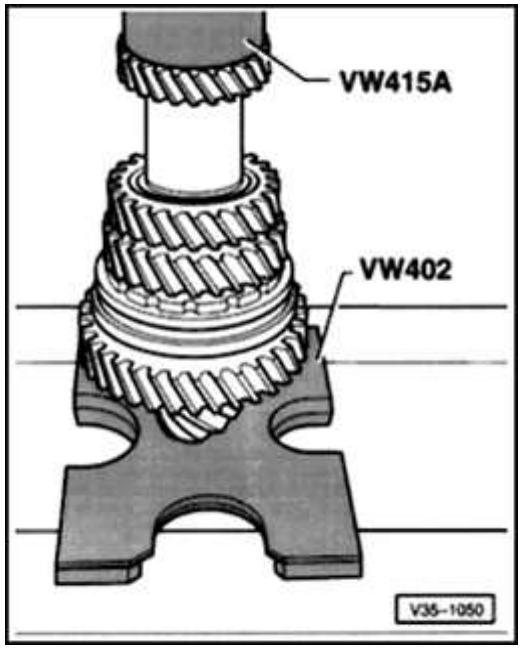


Fig. 21 Pressing on 4th gear

Installation position: higher inner collar faces 3rd gear.

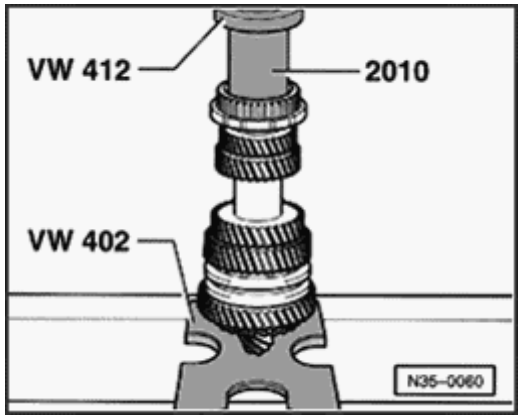


Fig. 22 Pressing on synchronizer hub for 5th and reverse gear

Installation position: higher inner collar faces 5th gear.

Note:

The large inner diameter of 2010 sleeve faces the synchronizer hub.

35-42

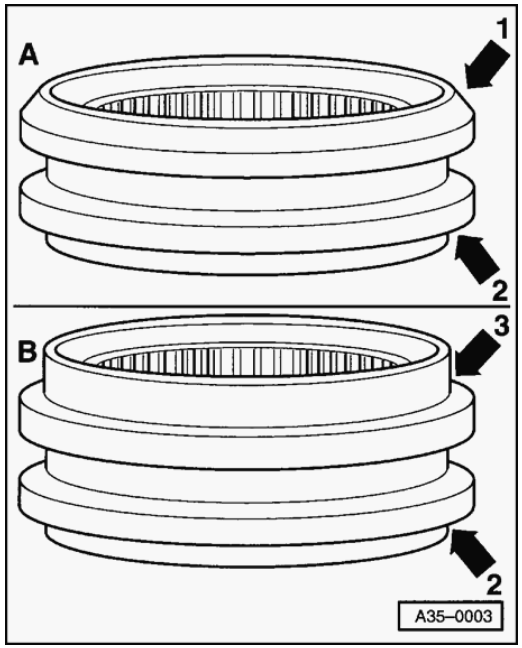


Fig. 23 Installation position of operating sleeve for 5th and reverse gear

Operating sleeves with chamfer -A- (arrow -1-), as well as operating sleeves with a large offset -B- (arrow -3-), are installed.

- Note the location of operating sleeve to reverse idler gear ⇒ Fig. 24 .
- Installation position:

  Chamfer (arrow -1-) faces 4th gear.

  Small stepped side (arrow -2-) faces 5th gear.

  Large stepped side (arrow -3-) faces reverse gear.

35-43

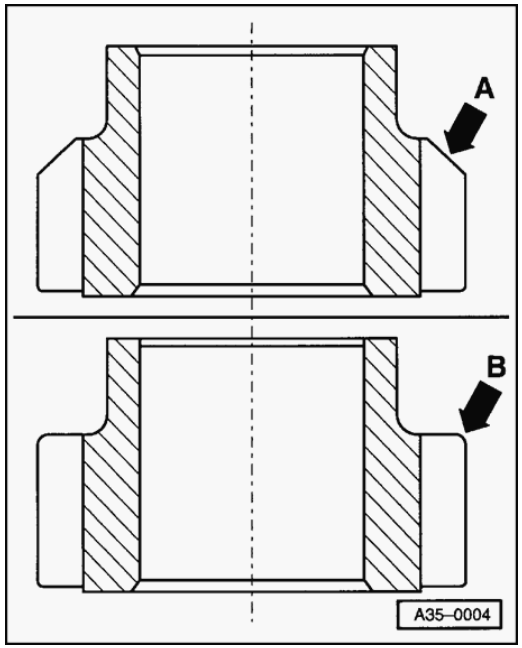


Fig. 24 Allocation of operating sleeve to reverse idler gear

A Reverse idler gear with chamfer	Both types of operating sleeves (with chamfer or with large offset) can be installed.
B Reverse idler gear without chamfer	Only operating sleeves with large offset can be installed. Do not install operating sleeve with chamfer.

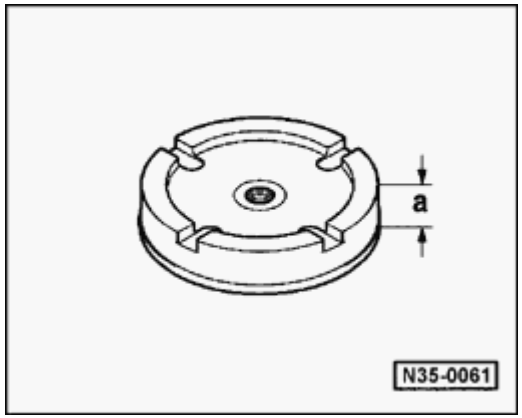
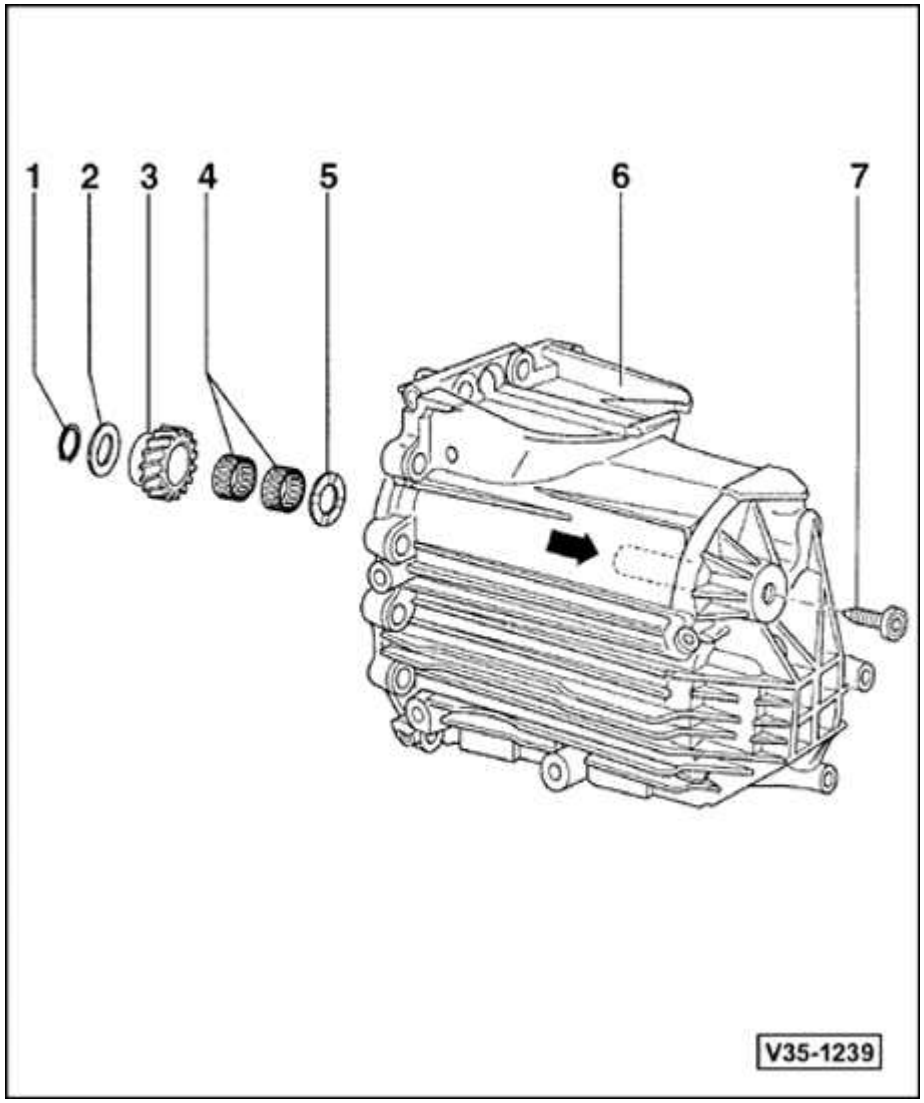


Fig. 25 Pressure plate variations

Transmission housing	Dimension -a-
Aluminum	14.8 or 15.3 mm

35-44



Reverse idler gear, removing and installing

1 - Circlip

2 - Brace

3 - Reverse idler gear

- Different versions, allocation ⇒ Fig. 24, ⇒ Page 35-43

4 - Needle bearing

5 - Thrust washer

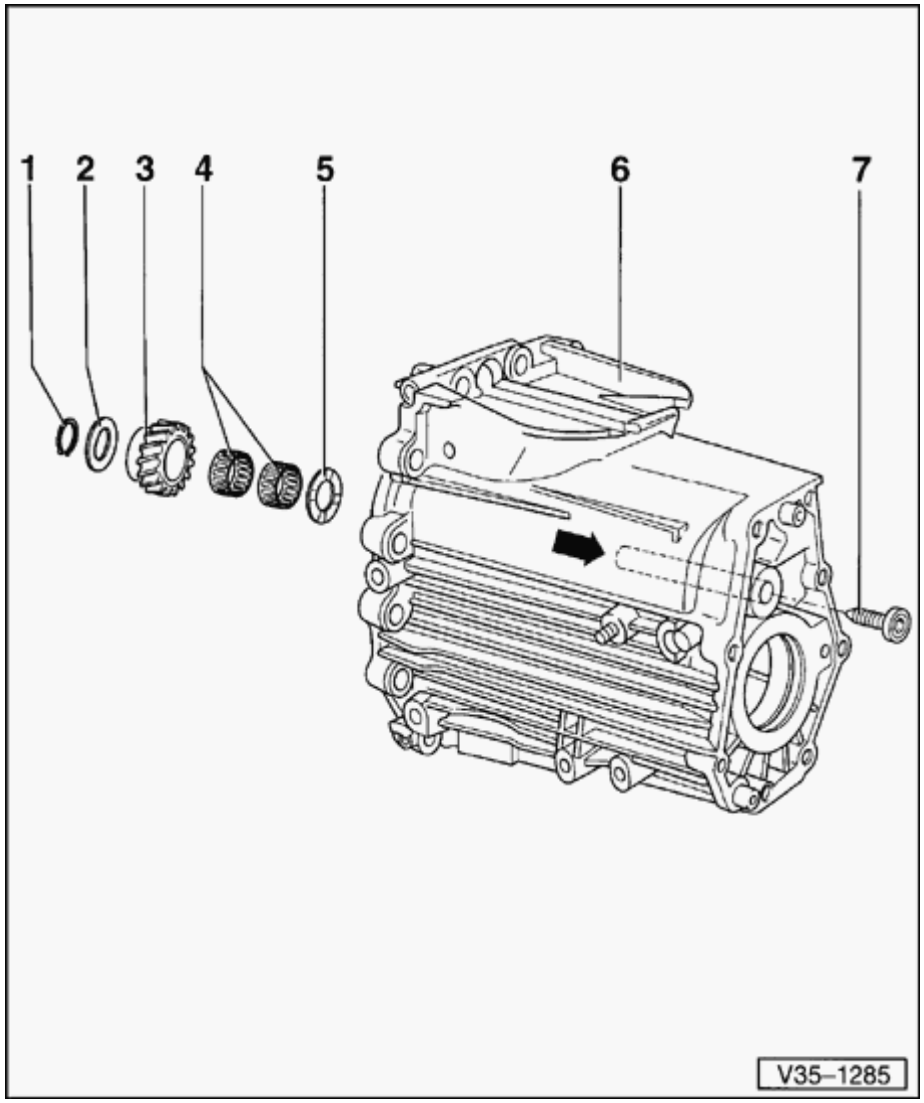
6 - Transmission cover

- With reverse idler gear shaft (arrow)
- To remove reverse idler gear it is not necessary to remove reverse idler gear shaft
- Reverse idler gear shaft is not available as a replacement part
- Coat sealing surfaces with a thin layer of sealant AMV 188 001 02

7 - Torx® bolt

- 35 Nm (26 ft lb)
- Serves as additional method of securing reverse idler gear shaft

35-44



Reverse idler gear, removing and installing

1 - Circlip

2 - Washer

3 - Reverse idler gear

- Different versions, allocation ⇒ Fig. 24, Page 35-43

4 - Needle bearings for reverse idler gear

5 - Thrust washer

6 - Transmission cover

- With reverse idler gear shaft (arrow)
- To remove reverse idler gear it is not necessary to remove reverse idler gear shaft.
- Reverse idler gear shaft is not available as replacement part

7 - Torx® bolt

- 35 Nm (26 ft lb)
- Serves as additional method of securing reverse idler gear shaft

37-1

Selector lever mechanism, servicing

WARNING!

Shift selector lever into position "P" and engage parking brake before working with the engine running.

Notes:

- *Lubricate bearing areas and slide surfaces with polycarbamide grease G 052 142 A2.*
- *Center console must be removed for service work:*

Ignition key removal lock, checking

- Switch ignition key to driving position (ignition on).
- Depress brake pedal and hold.
  - Shifting selector lever out of position "P" must be possible with the button at shift lever depressed without "sticking".
  - It must not be possible to remove ignition

key with selector lever in any position other than "P".

- Shift selector lever into position "P".

  - It must be possible to move ignition key into removal position without "sticking".

- Remove ignition key.

  - Selector lever cannot be shifted out of position "P" with the button pressed and foot brake operated.

37-2

Shift mechanism, checking

Selector lever in position "P" and ignition switched on:

- Brake pedal is not being operated:

Selector lever is locked and cannot be shifted out of position "P" with the button at selector lever pressed. Shift lock solenoid is locking the selector lever.

- Brake pedal is being operated:

Shift lock solenoid enables the selector lever. Selecting a driving mode must be possible with the button at shift handle pressed without "sticking".

Slowly shift selector lever through "P" via " R, N, D, 4, 3, 2", while checking if the selector lever position in instrument cluster matches with the selector lever position.

37-3

Selector lever in position "N" and ignition switched on:

- Brake pedal is not being operated:

  Selector lever is locked and cannot be shifted out of position "N" with the button at selector lever handle pressed. Shift lock solenoid is locking the selector lever.

- Brake pedal is being operated:

  Shift lock solenoid enables the selector lever. Selecting a driving mode must be possible with the button at shift handle pressed without "sticking".

Additional test only for shift mechanisms with Tiptronic: Selector lever in position "D", ignition and lights switched on

- Start engine and let run at idle

- Engage parking brake and operate brake pedal

  Guide selector lever out of selector lever position "D" into Tiptronic gate. Brightening of

"D" symbol on the shift mechanism cover must turn off and the "+" and "-" symbols must light up.

The display of the selector lever position in the instrument cluster must change from "PRND432" to "54321" when shifting selector lever into the Tiptronic gate.

37-4

Notes:

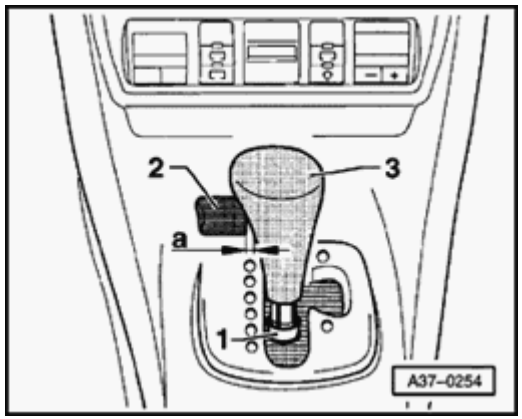
- *Starter must not start with selector lever in positions "2", "3", "4", "D" and "R".*
- *For Right Hand Drive (RHD) vehicles, it must only be possible to start the starter with the selector lever positions "P" and "N" with the locking button in selector lever handle not pressed.*
- *For speeds exceeding 5 km/h and shifting into selector lever position "N", the shift lock solenoid must not engage to lock the selector lever. Selector lever can be shifted into a driving mode.*
- *For speeds below 2 km/h (almost standstill) and shifting into selector lever position "N", the shift lock solenoid must only engage after approx. 1 second. Selector lever can only be shifted out of position "N" with the brake pedal operated.*

37-5

Shift operations, overview

A distinction is made between shift mechanisms with and without Tiptronic.

Notes:



- *For shift mechanisms with Tiptronic, the selector lever position D can be shifted into the Tiptronic gate by hand. In this gate, the next highest or lowest gear can be selected by pressing the selector lever forward or backward by hand.*
- *This additional Tiptronic gate is not installed in shift mechanisms without Tiptronic.*

Description of the Tiptronic shift mechanism ⇒ page 37-6 .

Description of the shift mechanism (without Tiptronic) ⇒ page 37-52 .

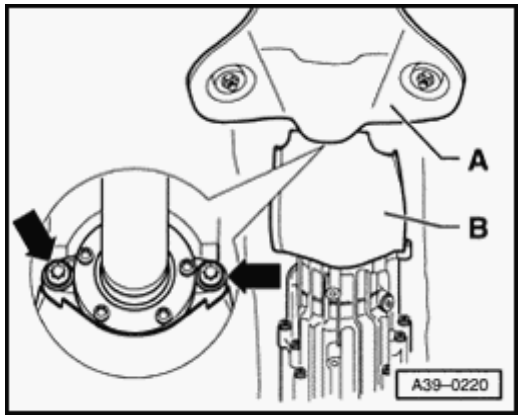
Tiptronic shift mechanism, removing and installing

Removing

- Shift selector lever into position "P".
- Note radio code (for vehicles equipped with coded anti-theft radio).
- Disconnect Ground (GND) strap from battery.
- Selector lever handle, removing ⇒ page 37-22 .
- Remove shift mechanism cover ⇒ page 37-24 .
- Raise vehicle.
- Disconnect front exhaust pipes with catalytic converter from the rear exhaust system and tie them up on side.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26, removing and installing exhaust system.*

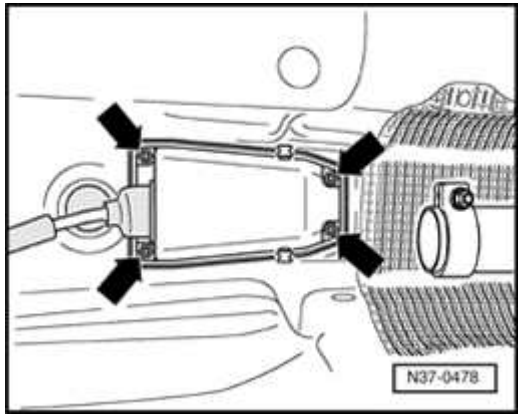
All-wheel-drive vehicles



- Remove heat shield -A- above driveshaft.
- Remove heat shield -2- for driveshaft from cover for Torsen differential (arrows).
- Unbolt driveshaft from transmission and hang or support.

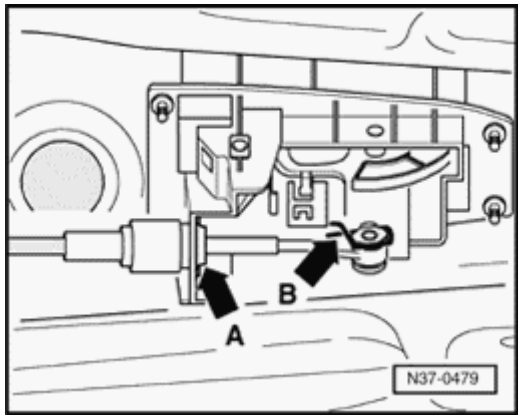
Continuation for all vehicles

- Loosen boot of selector lever cable from shift mechanism cover and slide back.



- Remove bolts (arrows) and remove shift mechanism cover.

37-8



- Press ends of locking clip -B- together and remove.
- Remove securing plate -A- for selector lever cable at shift mechanism downward.
- Remove selector lever cable from selector lever.

from top:

- Unclip locking cable from securing spring at shift mechanism housing, slightly lift up securing spring to do so.
- Remove nuts (4 pieces).

from below:

- Remove shift mechanism housing downward.
- Pull selector lever cable out of shift mechanism at the same time, and do not bend.

Installing

- Installation is the reverse order of removal.

In addition, the following test steps must be performed and observed.

- Selector lever and lever/shift rod in position "P" (park lock must engage).

- Raise vehicle.

- Guide selector lever cable into shift mechanism.

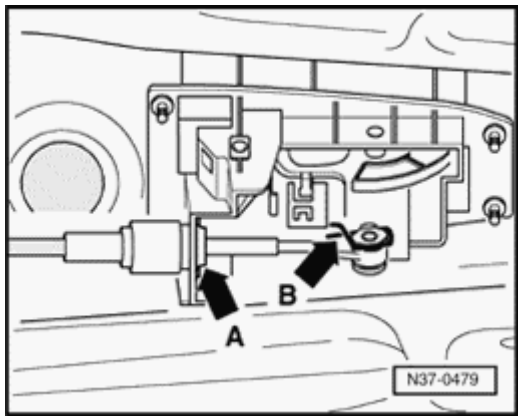
- Do not bend selector lever cable.

- Mount shift mechanism on chassis.

- Tighten nuts (4 pieces) to 10 Nm from top.

- Secure boot of selector lever cable to shift mechanism cover.

- Installing and adjusting locking cable ⇒ page 37-49 .



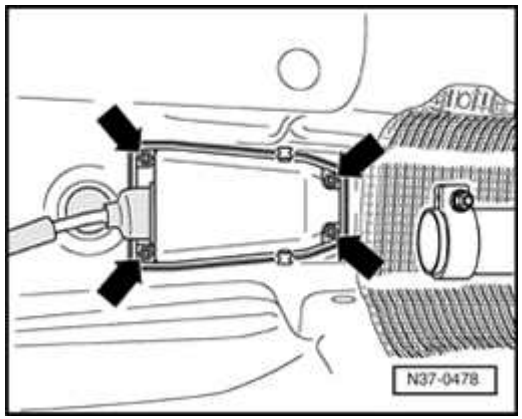
- Connect selector lever cable to selector lever.

- Install securing plate -A- for selector lever cable to shift mechanism.

Installation position:

Angled end of securing plate points toward the end of the selector lever cable.

- Press ends of locking clip -B- together and slide onto the end of the selector lever cable.



- Attach cover.

➢

- Tighten nuts (arrows, 4 pieces) to 10 Nm.
- Check adjustment of selector lever cable and adjust if necessary ⇒ page 37-45 .
- Ignition key removal lock, checking ⇒ page 37-1 .

All-wheel-drive vehicles

- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.
- Install heat shield.

Continuation for all vehicles

- Connecting front exhaust pipe to rear exhaust system.

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

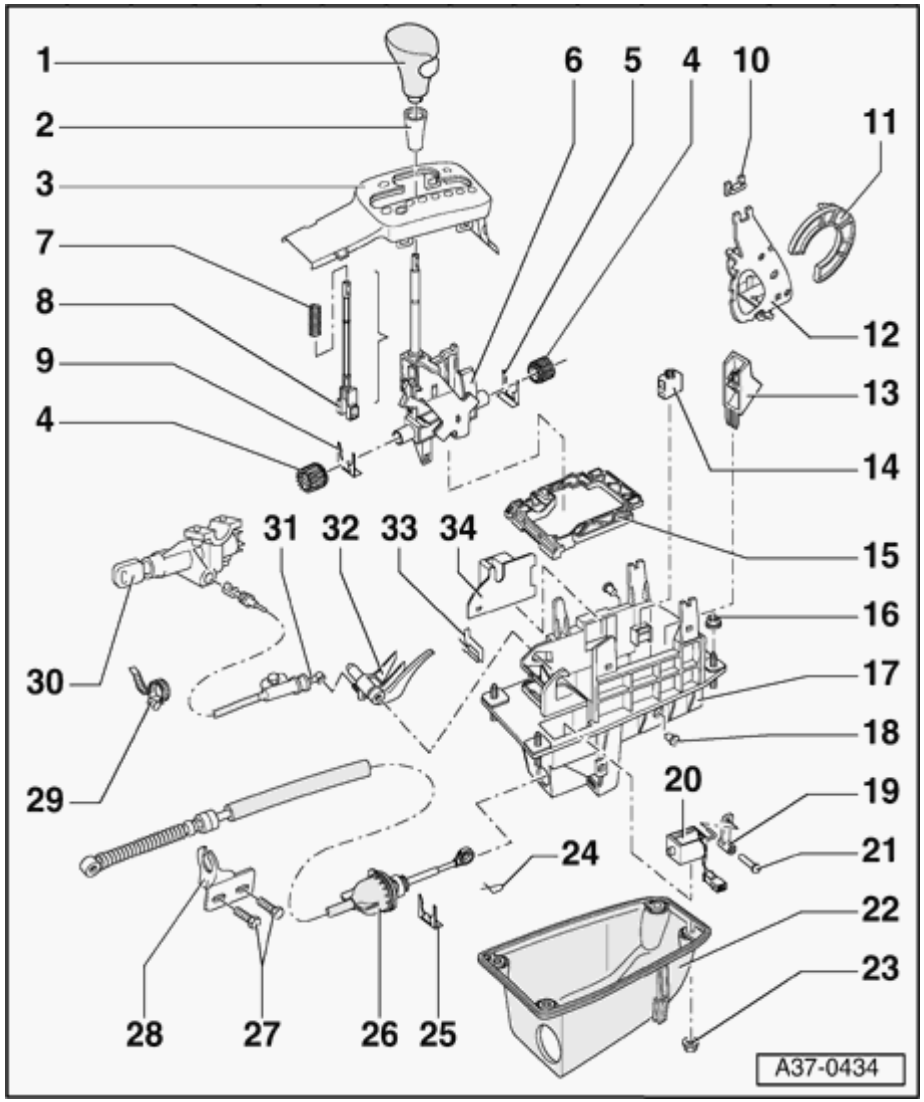
- Installing shift mechanism cover ⇒ page 37-24 .
- Selector lever handle, installing ⇒ page 37-22 .
- Connect battery Ground (GND) strap.
- For vehicles equipped with coded anti-theft radio, activate code.
- Check shift mechanism ⇒ page 37-2 .

37-11

Tightening torques:

Components	Tightening torques
Selector lever cable to mounting bracket	12 Nm
Mounting bracket to transmission (2 x M8)	23 Nm
Heat shield/selector lever cable to transmission, M6	9 Nm
Heat shield/selector lever cable to transmission, M8	23 Nm
Selector lever mechanism to chassis M6	8 Nm

37-12



Tiptronic shift mechanism, assembly overview

Assembly sequence ⇒ page 37-32

Lubricate bearing areas and slide surfaces with polycarbamide grease Part No. G 052 142 A2.

1 - Selector lever handle

- Removing and installing ⇒ page 37-22

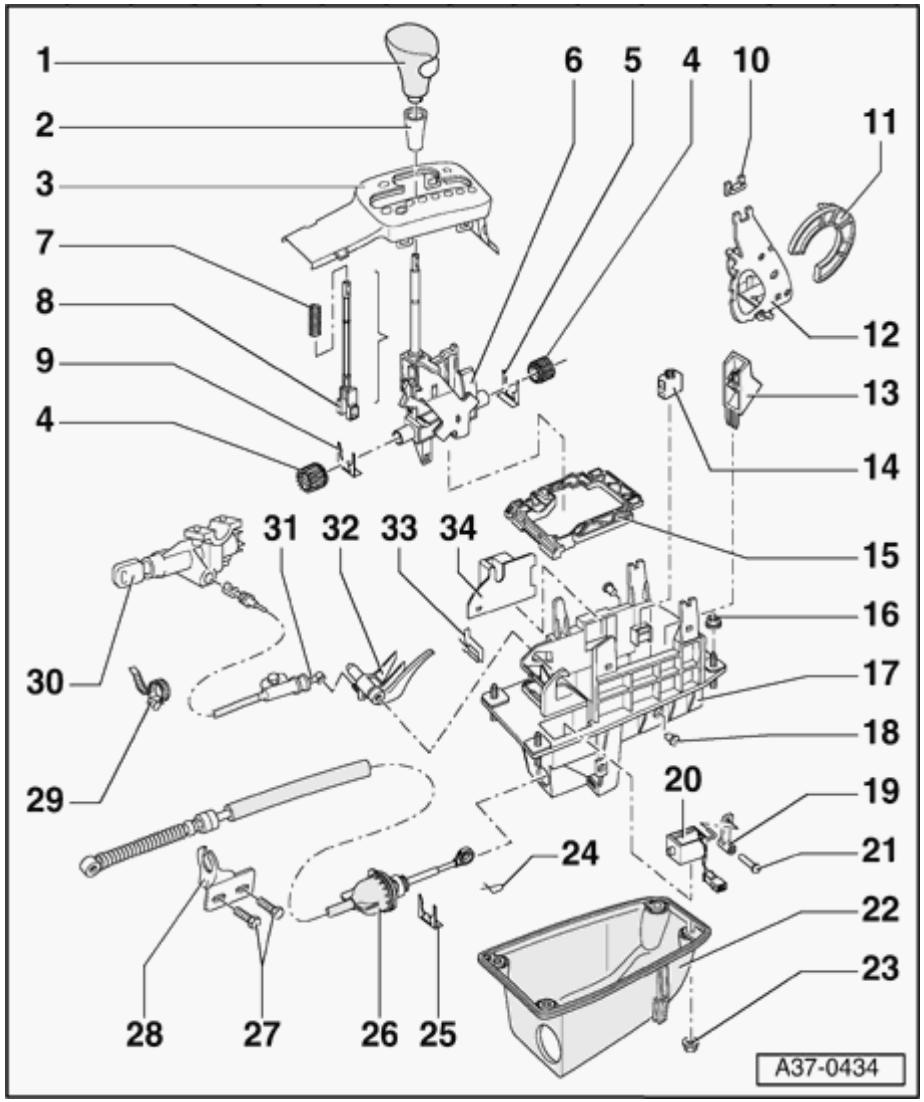
2 - Sleeve

- Engages in the selector lever handle

3 - Cover

- Removing and installing ⇒ page 37-24
- Disassembling and assembling ⇒ page 37-27

37-13



4 - Bearing bushing

- Use securing device - 5 - or secure 9 - in shift mechanism - 17
- Removing and installing ⇒ page 37-32

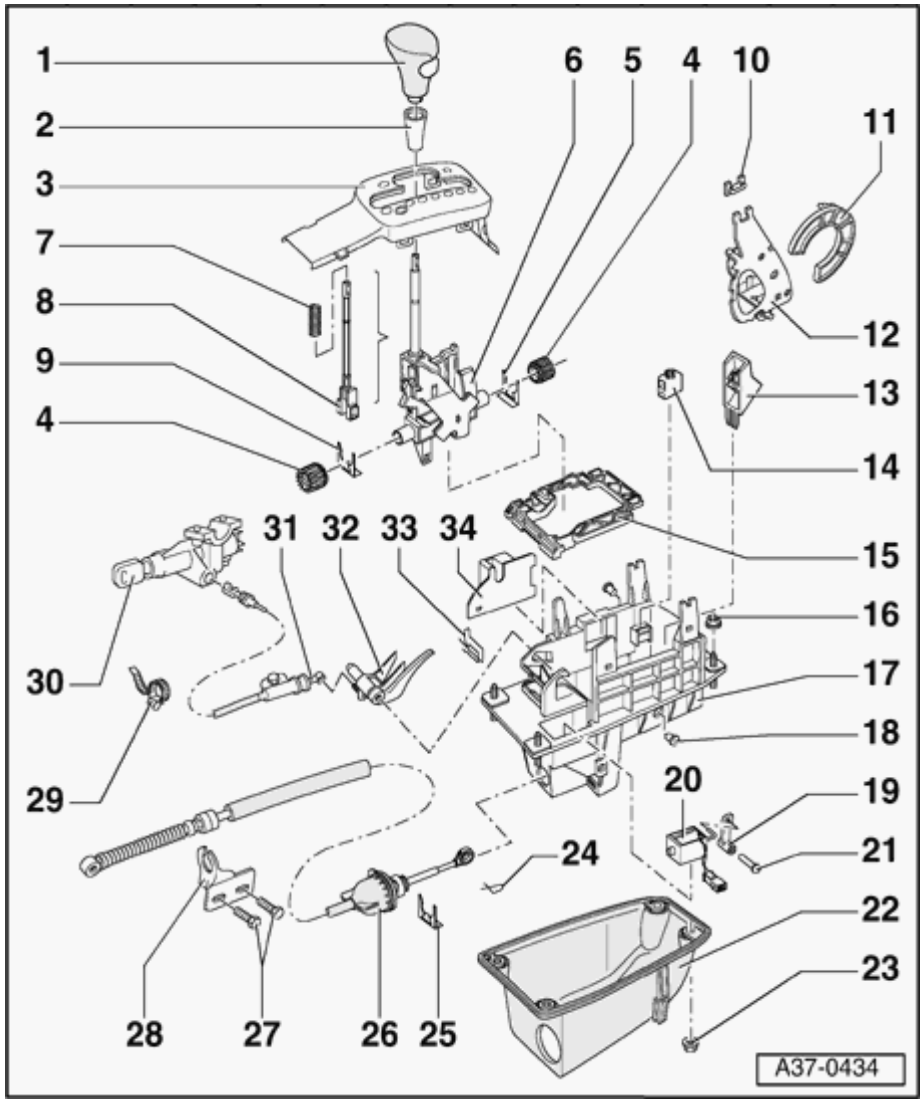
5 - Locking clip (thin, with tensioning spring)

- Secures bushing 17 - in shift mechanism- 4 -
- Installation position:Angled ends point to the inner shift mechanism housing

6 - Selector lever

- With pull-lever, compression spring, link and Tiptronic-spring system
- Removing and installing ⇒ Page 37-22 onward
- Disassembling and assembling ⇒ page 37-36

37-14



7 - Compression spring

- Removing and installing ⇒ Page 37-36 onward

8 - Pull-lever

- Removing and installing ⇒ Page 37-36 onward

9 - Locking clip (thick, with compression spring)

- Secures bushing 17 - in shift mechanism - 4 -
- Installation position:Angled ends point to the inner shift mechanism housing

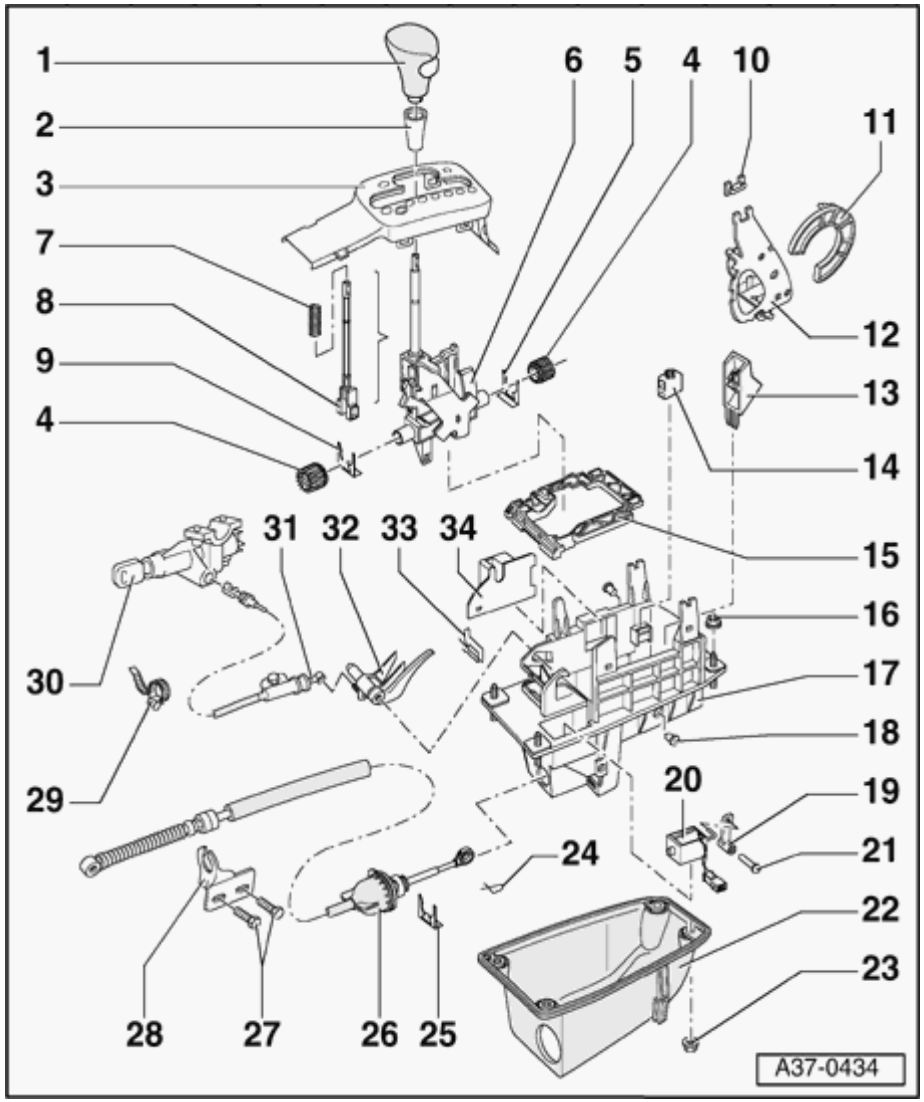
10 - Stop buffer

- Clip into cable lever - 12 -
- Installation position: Large contact surface to selector lever

11 - Catch

- Clip into cable lever - 12 -
- Removing and installing ⇒ page 37-32

37-15



12 - Cable lever

- With pivot pin - 18 - secured in shift mechanism housing - 17 -

13 - Catch spring with roller

- For shift positions
- Removing and installing ⇒ Page 37-32 onward

14 - Catch spring with roller

- For Tiptronic position
- Removing and installing ⇒ Page 37-32 onward

15 - Frame

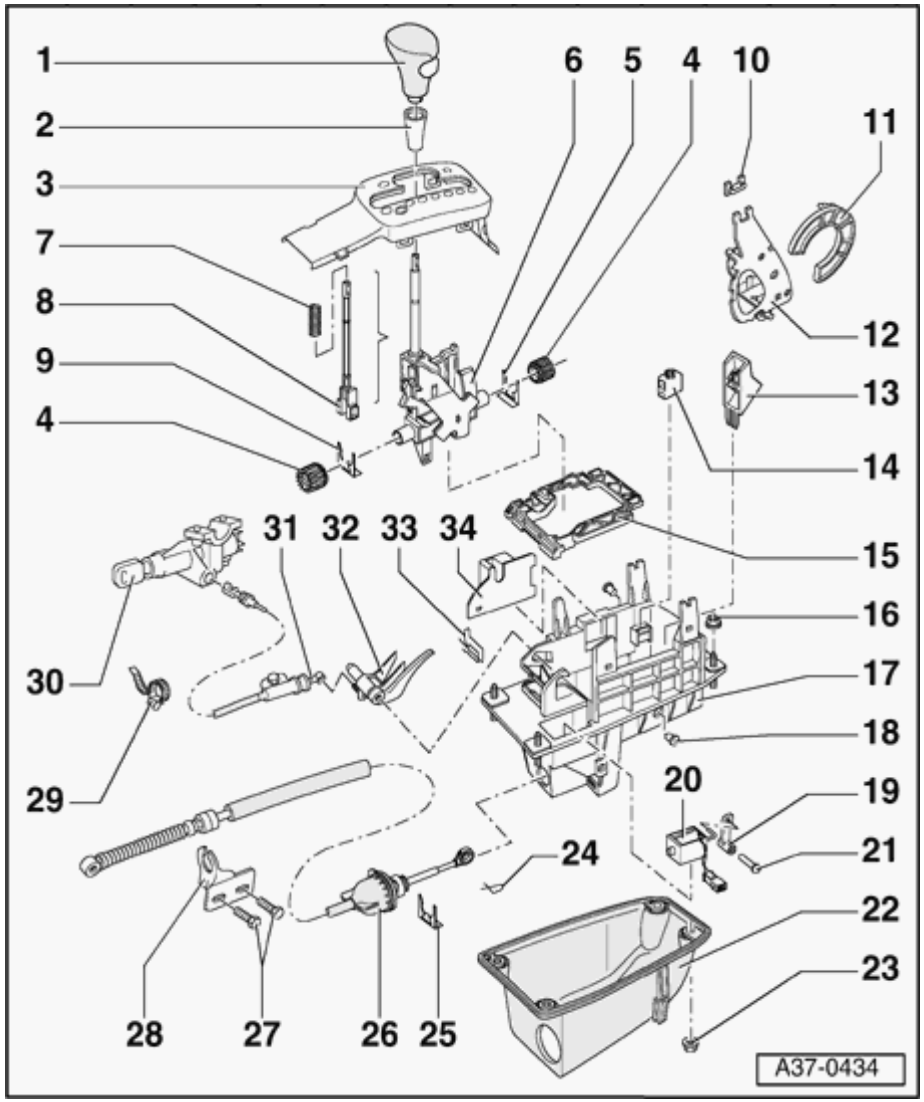
- Clip or bolt onto shift mechanism housing
- Installation position: Ribs toward top

16 - Nut, 10 Nm

17 - Shift mechanism housing

- Removing and installing ⇒ Page 37-6 onward

37-16



18 - Pivot pin

- Secures cable lever - 12 - in shift mechanism housing - 17 -

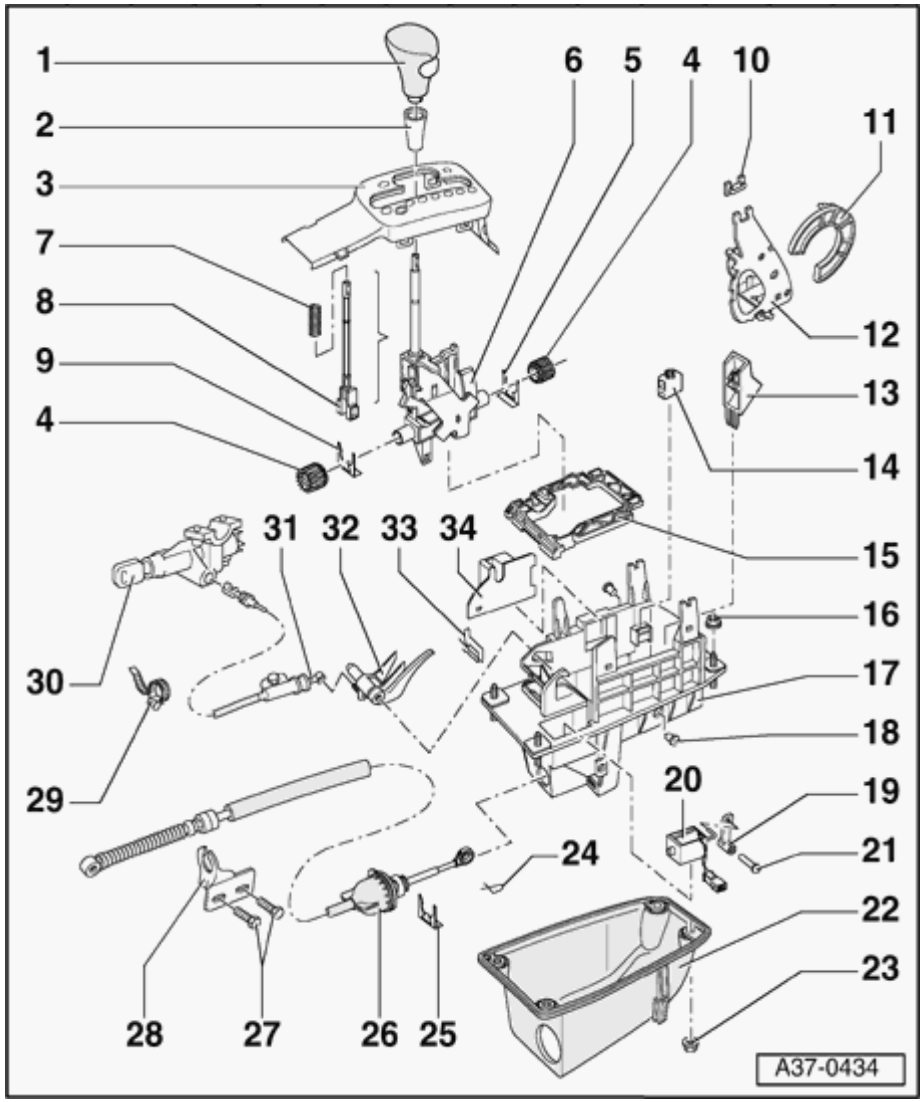
19 - Locking latch

- For shift lock solenoid
- Removing and installing ⇒ Page 37-32 onward

20 - Shift Lock Solenoid -N110-

- Removing and installing ⇒ Page 37-32 onward
- Can be checked via electrical test and read measuring value block

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01; Performing On Board Diagnostic (OBD)*



21 - Pivot pin

- For locking latch
- Removing and installing ⇒ Page 37-32 onward

22 - Cover

- With seal for shift mechanism housing
- Removing and installing ⇒ Page 37-6 onward

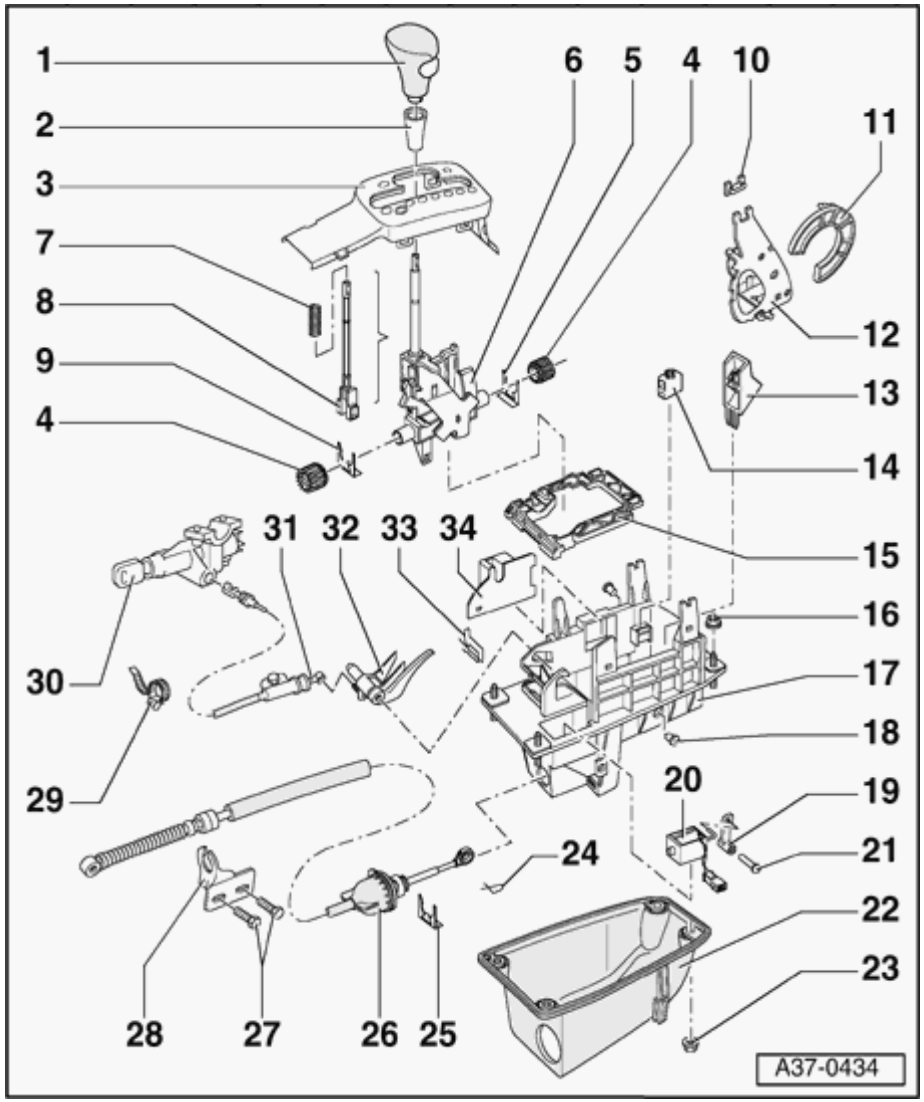
23 - Nut, 10 Nm

24 - Locking clamp

- For selector lever cable to cable lever - 12 -
- Install angled end toward front

25 - Locking plate

- For selector lever cable to shift mechanism housing
- Install angled end toward the inner shift mechanism housing



26 - Selector lever cable

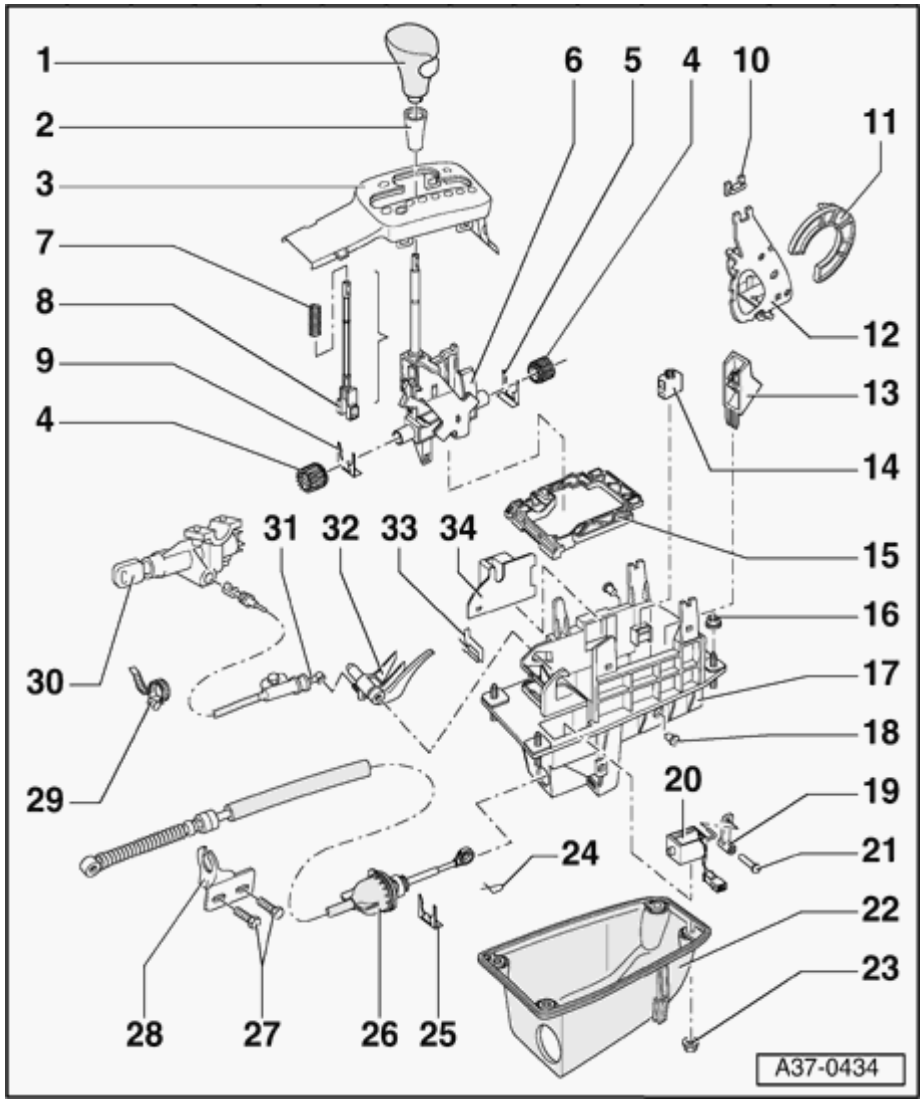
- Do not bend or kink, lightly grease coupling ring and ball socket before installing
- Removing and installing ⇒ page 37-40
- Adjusting ⇒ page 37-45
- In case of damaged rubber boots, the selector lever cable must be replaced
- Do not install rubber boot on transmission side twisted

27 - Hex bolt, 23 Nm

28 - Pivot

- For selector lever cable to transmission
- Removing and installing ⇒ page 37-40

37-19



29 - Cable ties

- For locking cable

30 - Ignition/Starter Switch

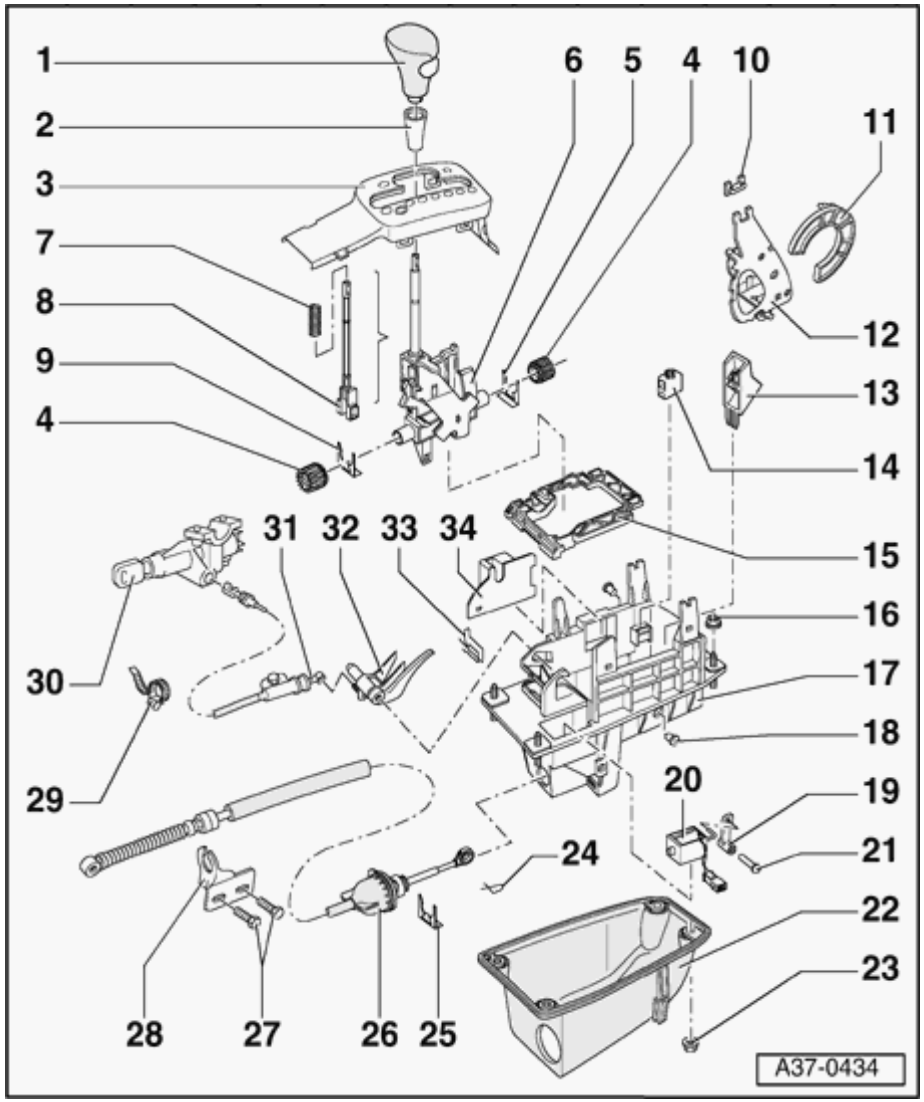
31 - Locking cable

- For ignition key removal lock
- Must not be kinked
- Removing and installing ⇒ page 37-47
- Adjusting ⇒ page 37-50

32 - Catch lever

- For ignition key removal lock
- Removing and installing ⇒ Page 37-32 onward

37-20



33 - Retaining spring

- For locking cable
- Removing and installing ⇒ Fig. 1 , ⇒ page 37-21

34 - Storing

- For selector lever in Tiptronic position
- Removing and installing ⇒ Page 37-32 onward

37-21

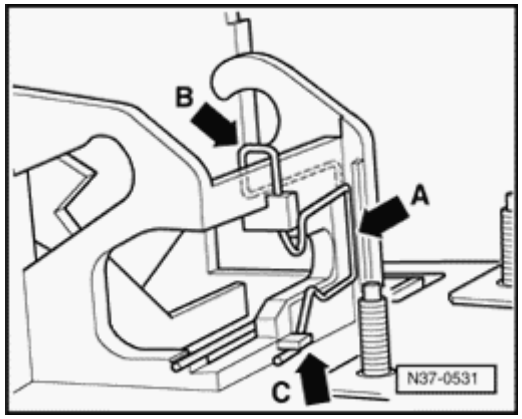


Fig. 1 Securing spring for locking cable, removing and installing

Removing

- To remove locking cable, slightly lift spring at top (arrow B).
- Unhook spring (arrow A) at retaining clip (arrow C) and remove toward top.

Installing

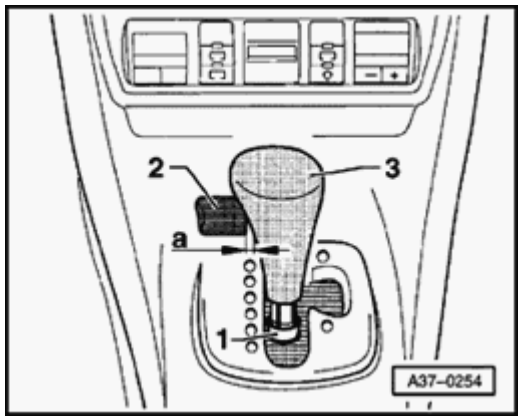
- Insert spring (arrow B) from top and hook in at retaining clip (arrow C).
- Align spring so that it is seated evenly in groove (arrow A).
- To install locking cable, slightly lift spring at top (arrow B).

37-22

Selector lever handle, removing and installing

Removing

- Shift selector lever into position "3".



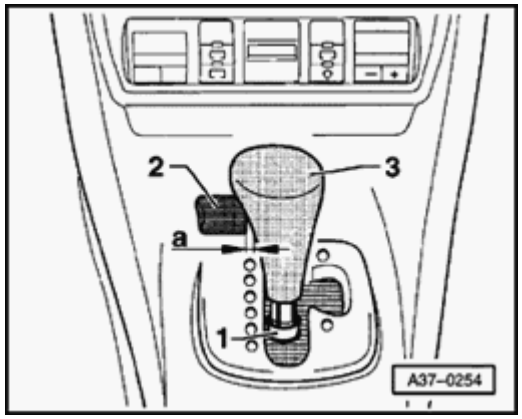
- Slide sleeve -1- downward toward stop.
- Pull button -2- out of selector lever handle -3- up to engagement point (dimension -a-) and pull upward.

Dimension -a- = 3 mm

Installing

- Shift selector lever into position "N".
- Carefully pull button -2- out of selector lever handle -3- up to dimension -a-.
- At the same time, place handle -3- with button -2- onto selector lever up to stop in direction of travel.
- Turn handle -3- so that button -2- points toward the driver. During this, the handle engages in a vertical groove of the selector lever.

37-23



- Completely install handle -3- on the selector lever. During this, it must engage in a ring groove of the selector lever.
- Press button -2- into selector lever handle -3-.
- Pull up sleeve -1- until it engages in selector lever handle -3-.

Cover for Tiptronic shift mechanism, removing and installing

Removing:

- Remove cover of center console above shift mechanism.

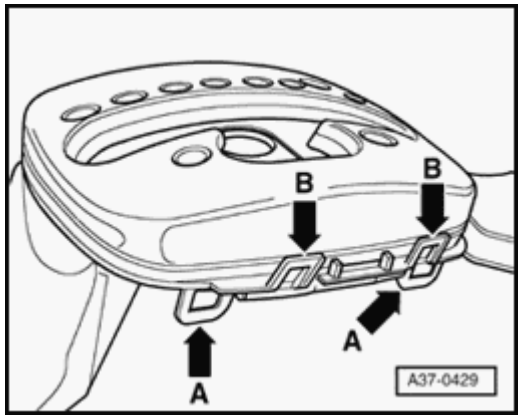
⇒ *Repair Manual, Body Interior, Repair Group 68; Storage compartments, covers and trim; Center console, removing.*

- Selector lever handle, removing ⇒ page 37-22 .

- Shift selector lever into position "P" by pulling pull rod.

- Switch off ignition.

37-25



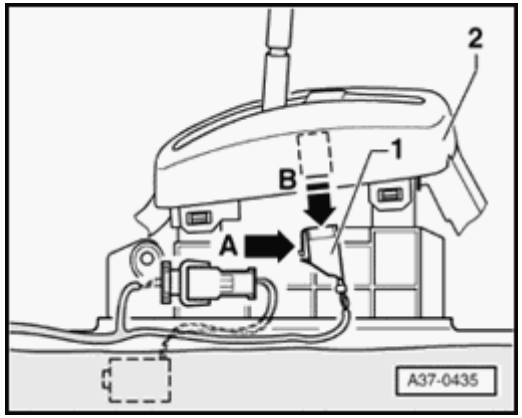
- Carefully pry out the four retaining straps (arrow A) from top using bent wire or hook (retainer strap are difficult to see from top).

Under no circumstances may the four retaining straps (arrow B) which are visible from top be pried out, otherwise the circuit board will be destroyed. In addition, the chromed upper part is permanently bonded to the upper enclosure cover.

Note:

If the four retaining straps (arrow A) cannot be pried out with bent wire or a hook, the center console must be removed to gain better access.

- Remove complete shift mechanism cover upward.



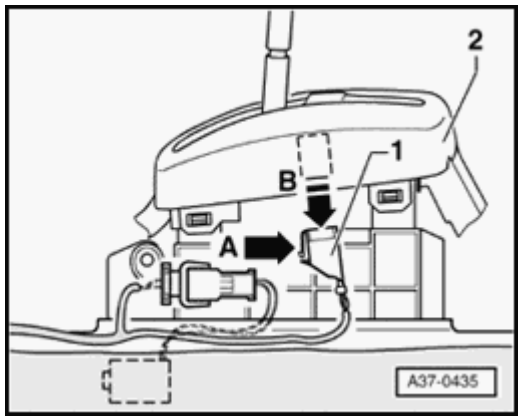
- Press release (arrow A) at connector -1- and pull it out of the cover in direction of arrow -B-.

Note:

If the retaining straps are damaged, the upper cover must be replaced Item , ⇒ page 37-27 .

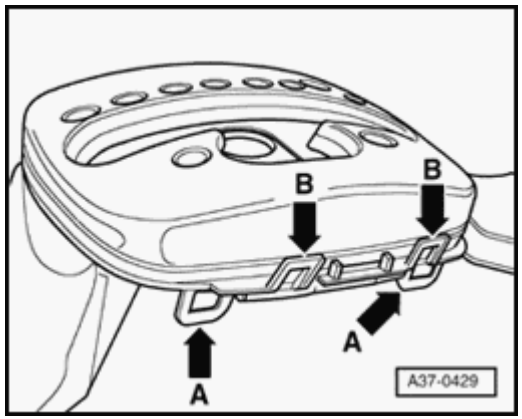
Installing:

Installation is the reverse of removal. The following points must also be observed:



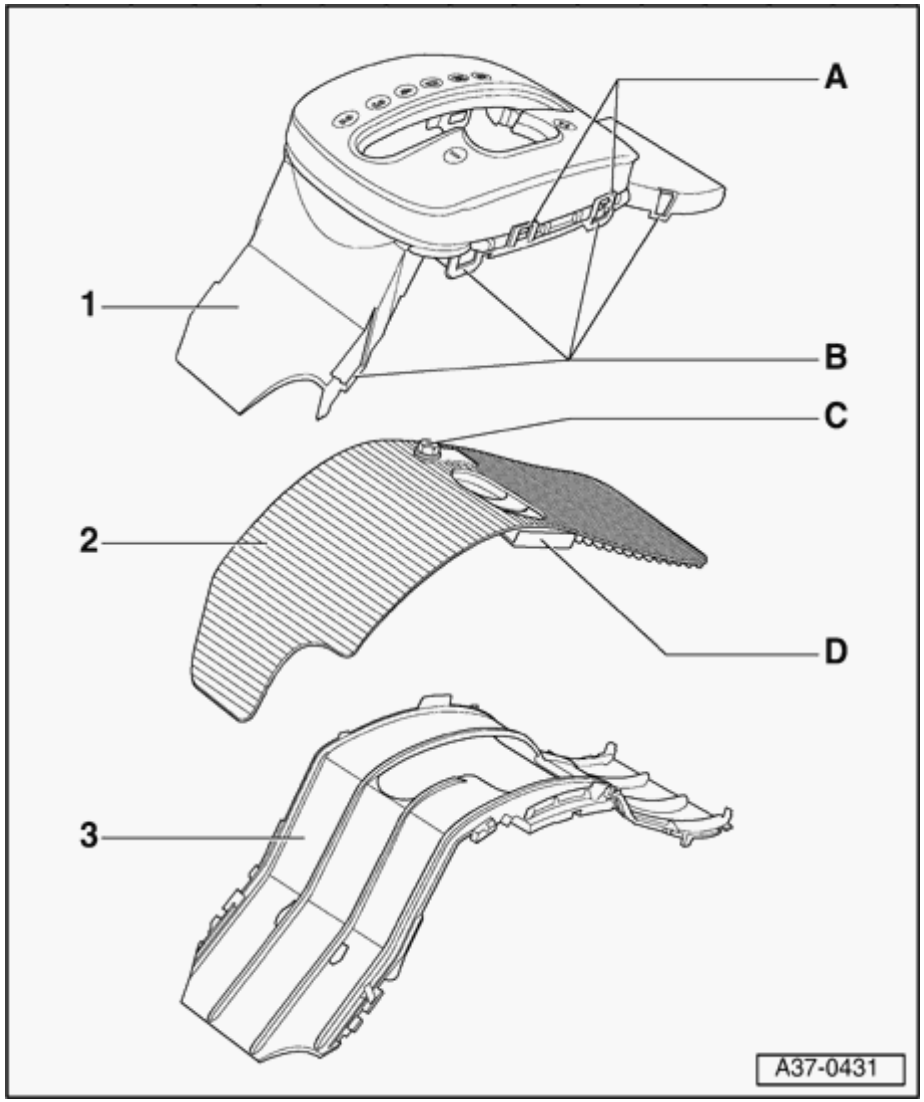
- Insert connector -1- into cover opposite direction of arrow -B- before they are clipped into the shift mechanism.
- Clip cover onto shift mechanism.

Note:



When clipping on, make sure the retaining straps (arrow A) are not being bent inward. Retaining tabs of shift mechanism must engage on outside without excessive force.

37-27



Cover for Tiptronic shift mechanism, disassembling and assembling

Overview

1 - Upper cover

- With integrated Tiptronic Switch -F189-
- Tiptronic Switch -F189-, removing and installing ⇒ page 37-30

2 - Masking panel

- With integrated solenoids -C- and -D-

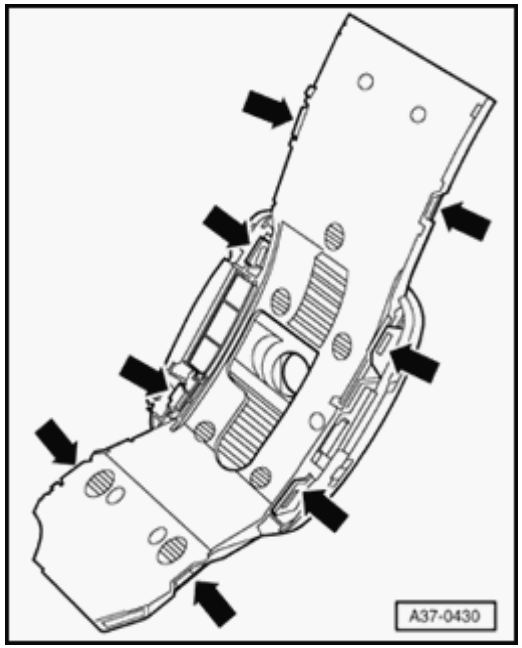
3 - Lower cover

- Guides the masking panel

Disassembly of suspension strut

- Remove shift mechanism cover ⇒ page 37-24

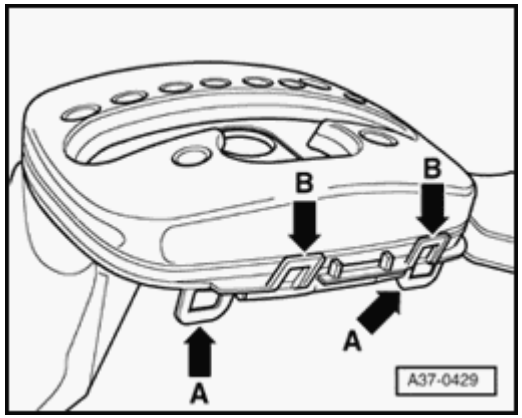
37-28



- Carefully pry out retaining straps (arrows).

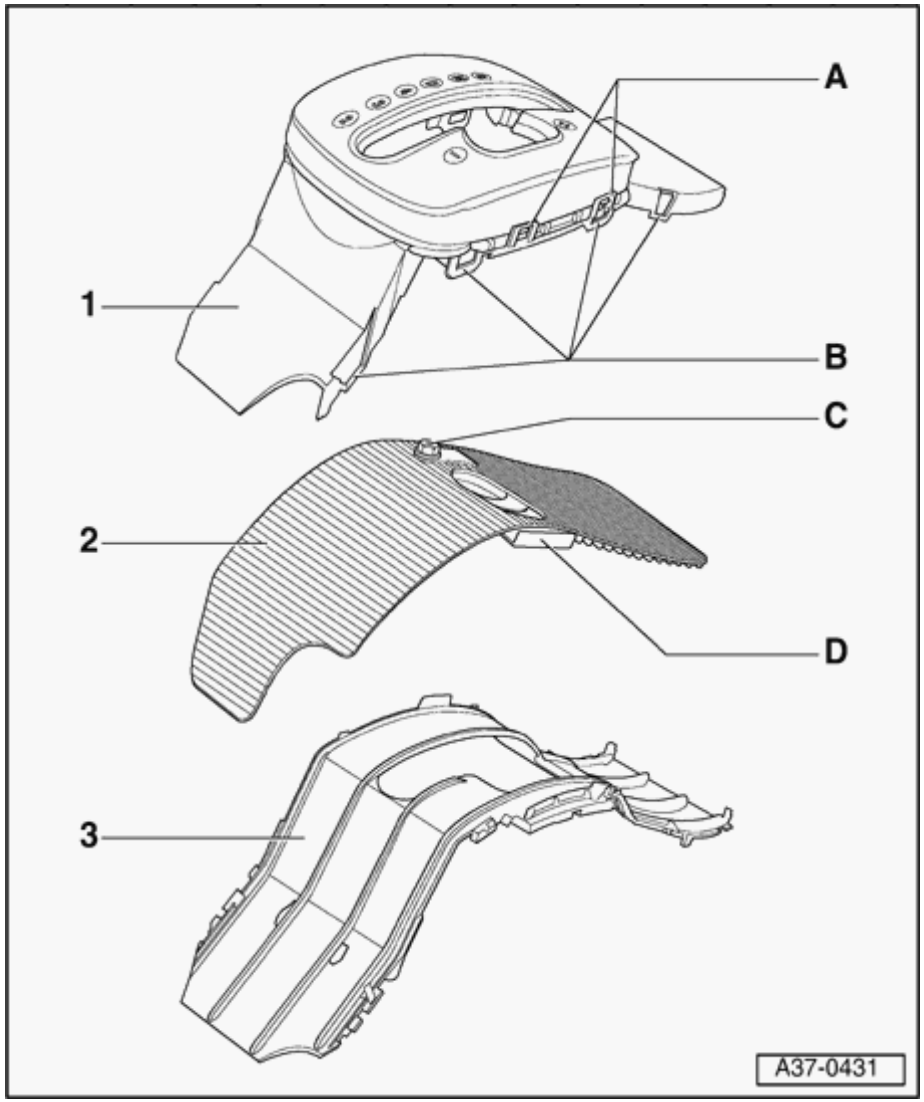
Note:

If the retaining straps are damaged, the upper cover must be replaced Item , ⇒ page 37-27 .



Under no circumstances may the four retaining straps (arrow B) which are visible from top be pried out, otherwise the circuit board will be destroyed. In addition, the chromed upper part is permanently bonded to the upper enclosure cover.

37-29



- Remove lower cover -3- and masking panel -2-.

Assembly

- Lay masking panel -2- into upper cover, installation position analog display.

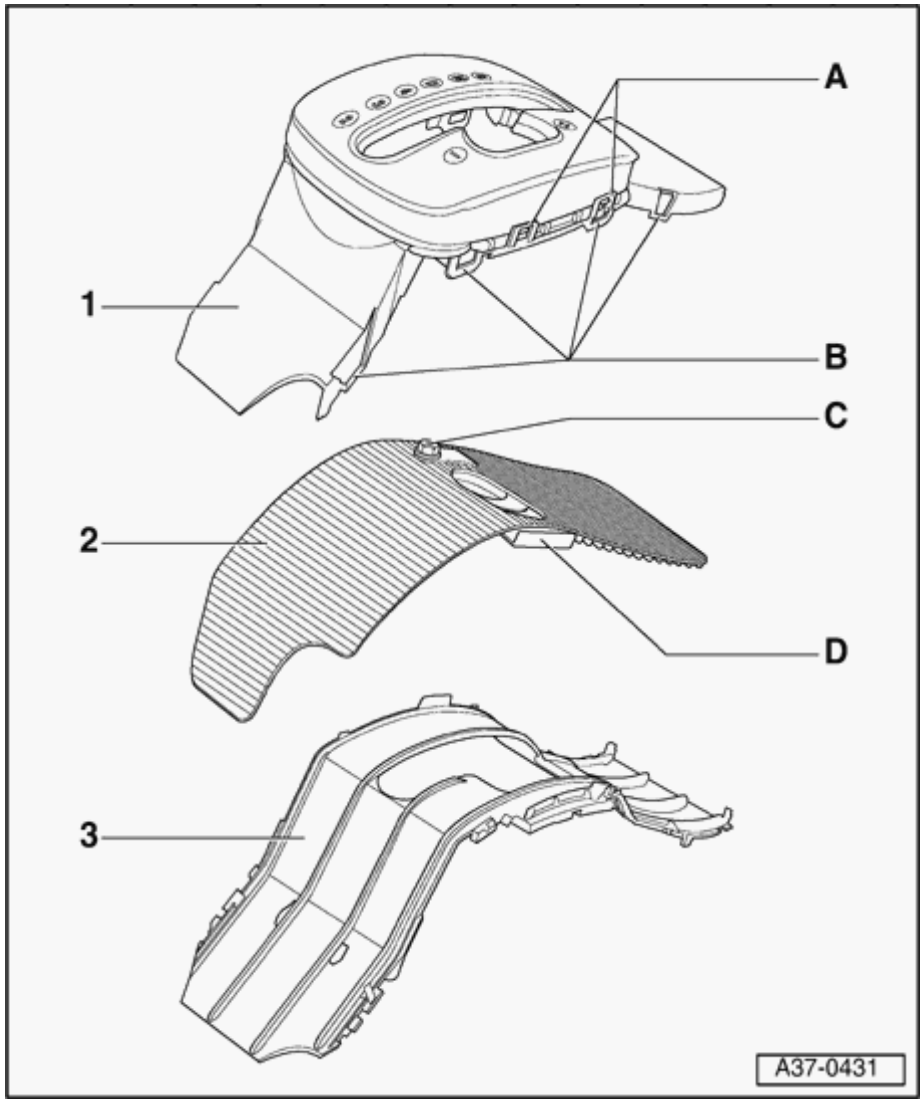
Solenoids -C- and -D- must be securely fastened on masking panel, if necessary masking panel must be replaced.

- Carefully clip lower cover -3- into upper cover -1-.

If retaining straps -A- or -B- are damaged, the upper cover must be replaced.

- Install shift mechanism cover ⇒ page 37-24

37-30



Tiptronic Switch -F189-, removing and installing

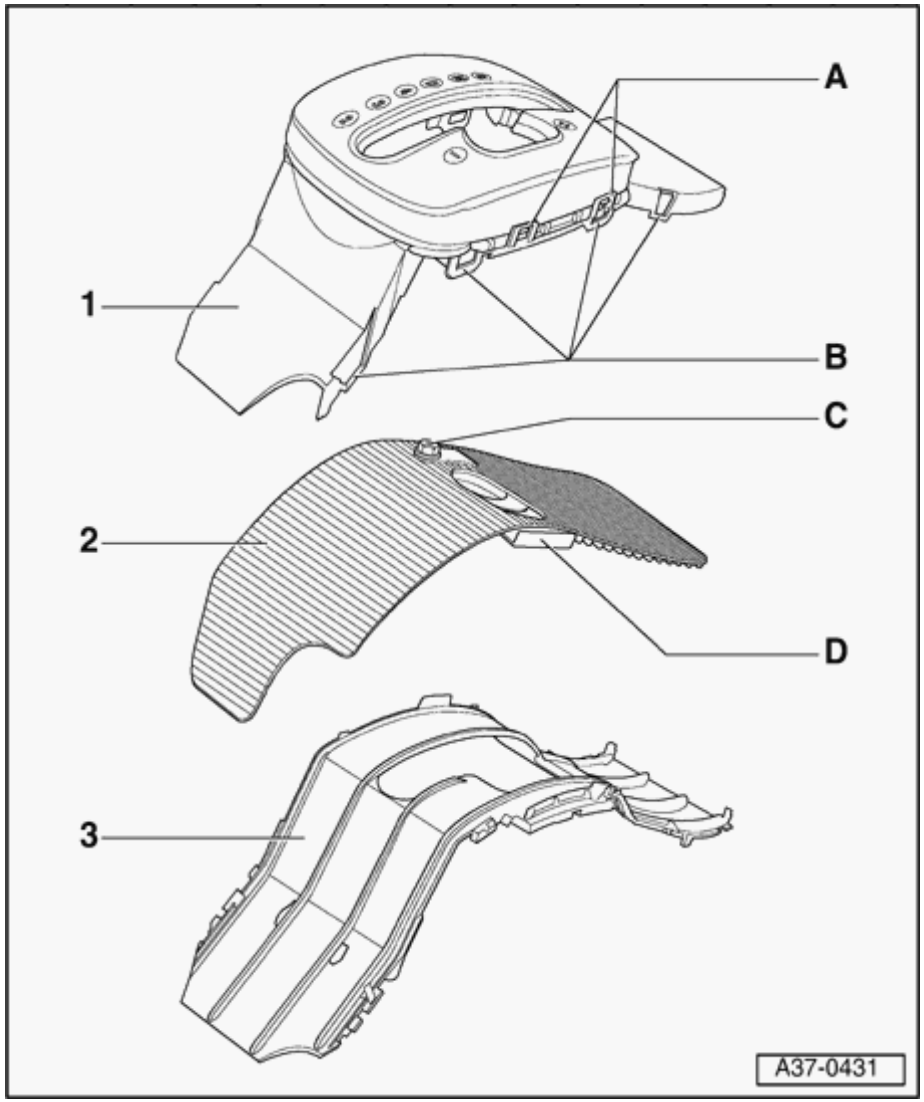
Installation location:

The Tiptronic switch is integrated into the upper cover -1- of shift mechanism.

- For occurring malfunctions, the Tiptronic switch must be checked for interference in Measuring Value Block and in the electrical test. Tiptronic switch must only be replaced after wiring test. For vehicles with Tiptronic sport steering wheel, the buttons at steering wheel and their wire connections must be checked.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01; Performing On Board Diagnostic (OBD)*

37-31



Removing:

- Disassemble shift mechanism cover ⇒ page 37-27

Notes:

Solenoids -C- and -D- must be securely fastened on masking panel, if necessary masking panel must be replaced.

If solenoid -D- is missing (or has fallen out), Tiptronic switch will not work, i.e. masking panel must be replaced. In this case the Tiptronic switch must not be replaced.

- To replace Tiptronic switch, upper cover -1- must be replaced.

Installing:

- Install shift mechanism cover ⇒ page 37-27

Tiptronic shift mechanism, disassembling and assembling (sequence)

Disassembly of suspension strut

- Remove shift mechanism ⇒ page 37-6 .
- First remove stop buffers from cable lever
- Shift selector lever into Tiptronic position and then remove frame.
- Shift selector lever into position "2".
- Disengage lever for locking cable by lifting it out of its bearing and remove from shift mechanism housing.
- Shift selector lever into position "D".
- Catch spring for Tiptronic position is carefully pried out of the shift mechanism housing from the outside.
- Pull out retainer for selector lever bushings.

- Using a screwdriver, press out selector lever bushings outward.

37-33

- Remove complete selector lever.

- Disassemble selector lever ⇒ page 37-36 .

- To remove bearing for Tiptronic position of selector lever, unlatch retaining tabs at shift mechanism housing and remove bearing inward.

- Press out pin for locking latch using a drift.

- Remove shift lock solenoid together with locking latch upward.

- Catch spring for selector lever positions is carefully pried out of the shift mechanism housing from the outside.

- Pry out both pins of the cable lever/catch.

- Pull cable lever/catch with opening of the catch out of the shift mechanism housing upward.

- Unclip catch from the cable lever.

37-34

Assembly of suspension strut

- Clip catch into cable lever.
- Slide cable lever/catch into the shift mechanism housing with opening of the catch forward.
- Drive both pins of the cable lever/catch into the shift mechanism housing from both sides up to stop.
- Press catch spring with roller for selector lever position into its mount in shift mechanism housing up to stop.
- Shift lock solenoid together with locking latch must be slid into the shift mechanism housing from the top.
- Carefully drive in pin for locking latch.
- Using a screwdriver, mechanically check for engagement of the locking latch in position "P" and "N" of selector lever.
- Insert complete selector lever into shift mechanism housing.

- Hook selector lever into cable lever at bottom and top.

37-35

- Slide both selector lever bushings into the shift mechanism housing at front or rear.

- Install bearing bushing into shift mechanism housing so that the angled ends point inward.

- Press catch spring for Tiptronic position into its mount in shift mechanism housing up to stop.

- Shift selector lever into position "2".

- Lay cable lever into shift mechanism housing and engage it noticeably in both bearing areas.

- Check locking function of locking lever. In selector lever position "P", it must engage in the catch and lock the shift mechanism.

- Set frame onto shift mechanism housing (ribbing points upward) and insert buffer stop into cable lever.

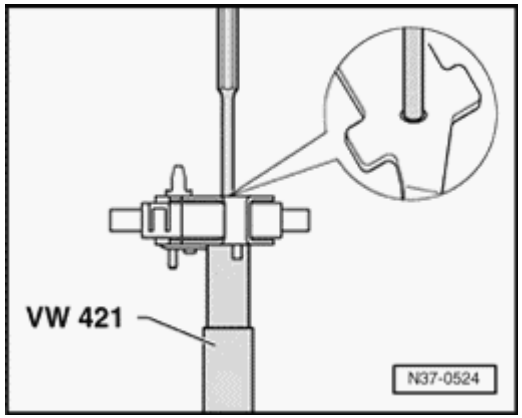
- Install shift mechanism ⇒ page 37-6 .

37-36

Selector lever, disassembling and assembling

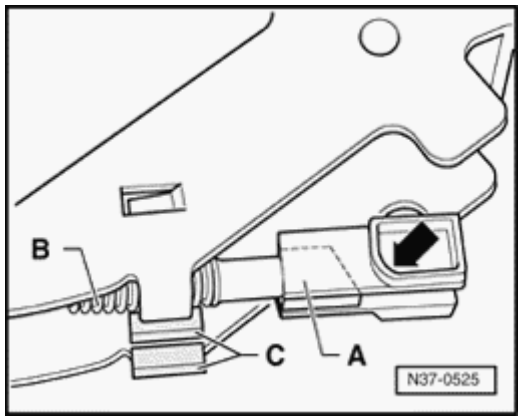
- Remove selector lever ⇒ page 37-32 .

Disassembly of suspension strut



- Drive out selector lever pivot pin using a drift.
- Slide link with Tiptronic spring with raised pulling rod out of the selector lever.
- Release tension of compression spring and also remove pull-lever and compression spring from the selector lever.

Assembly of suspension strut



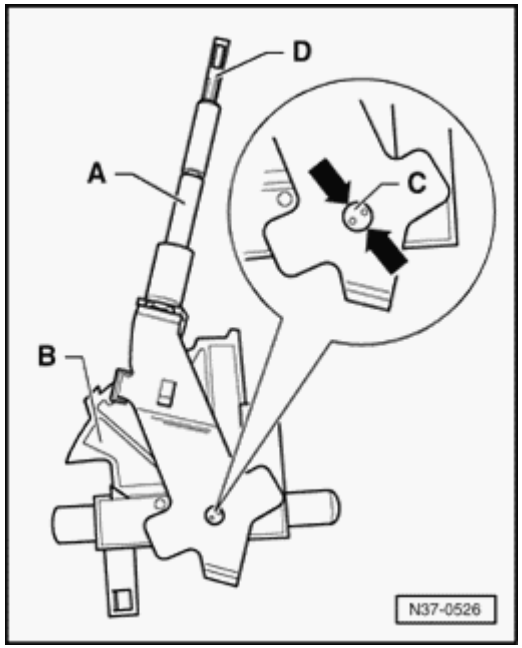
- Set compression spring -B- onto pull-lever -A-.
- Guide pull-rod with compression spring into the selector lever.

Installation position:

Curvature and edge point in direction of travel.

- Check whether the pull-lever glides on both guides -C- of selector lever.

37-37



- Slide link -B- with Tiptronic spring mechanism into selector lever -A- with pull-lever -D- raised.
- Drive pivot pin -C- into selector lever using a drift ⇒ page 37-36 , ⇒illustration N37-0524.
- To secure, make two new center punch marks (arrows) offset by 90 ° to the existing ones.

Pivot pin can have a maximum of 4 center punch marks.

- Install selector lever ⇒ page 37-34 .

37-38

Shift lock solenoid, removing and installing

Removing

- Remove shift mechanism ⇒ page 37-6 .
- Remove stop buffer from cable lever.
- Shift selector lever into Tiptronic position and then remove frame.
- Shift selector lever into position "2".
- Disengage lever for locking cable by lifting it out of its bearing and remove from shift mechanism housing.
- Press out pin for locking latch using a drift.
- Remove shift lock solenoid together with locking latch upward.

37-39

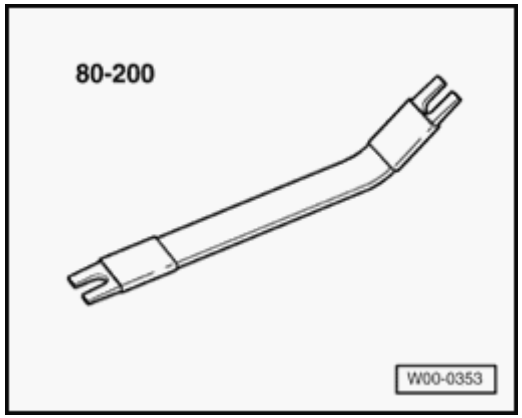
Installing

- Shift selector lever into position "2".
- Shift lock solenoid together with locking latch must be slid into the shift mechanism housing from the top.
- Carefully drive in pin for locking latch.
- Using a screwdriver, mechanically check for engagement of the locking latch in position "P" and "N" of selector lever.
- Lay cable lever into shift mechanism housing and engage it noticeably in both bearing areas.
- Check locking function of locking lever. In selector lever position "P", it must engage in the catch and lock the shift mechanism.
- Set frame onto shift mechanism housing (ribbing points upward) and insert buffer stop into cable lever.
- Install shift mechanism ⇒ page 37-6 .

37-40

Selector lever cable for Tiptronic shift mechanism, removing and installing

Special tools and equipment



- 80-200 Pry lever

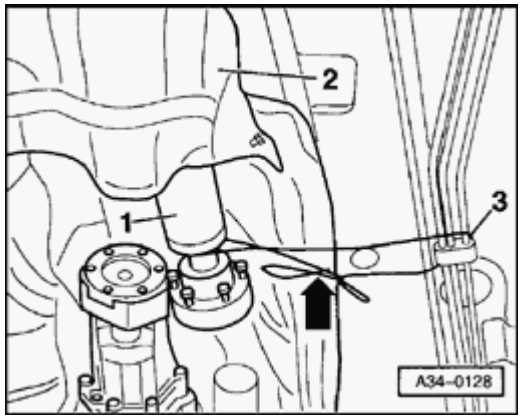
Removing

- Shift selector lever into position "P".
- Raise vehicle.
- Remove crossmember below exhaust system if installed.
- Disconnect front exhaust pipes with catalytic converter from the rear exhaust system and tie them up on side;

⇒ *Repair Manual, Engine Mechanical, Repair Group 26, removing and installing exhaust system*

37-41

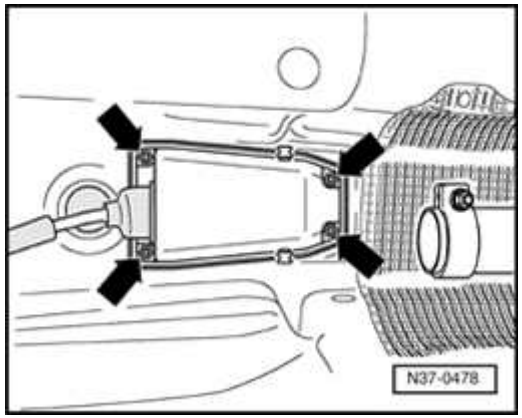
All-wheel-drive vehicles



- Unbolt driveshaft -1- from transmission and let rest on heat shield -2- ⇒ page 39-79 , Driveshaft, removing and installing.
- Secure driveshaft using wire (arrow) at bracket -3- of fuel lines.

Continuation for all vehicles

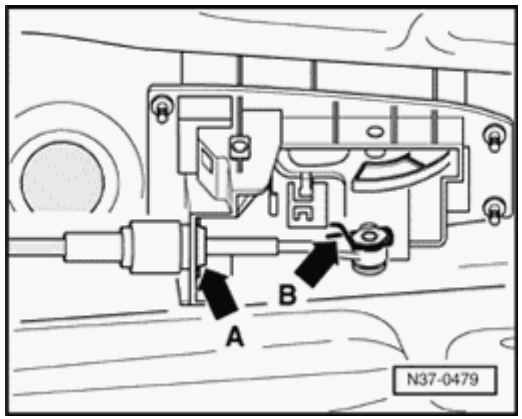
- Unbolt heat shield from below shift mechanism housing.



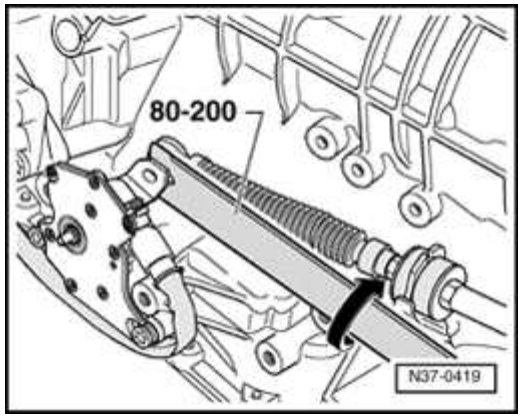
- Remove cover from shift mechanism housing (arrows).

37-42

Disconnect selector lever cable from shift mechanism housing:



- Press ends of locking clip -B- together and remove.
- Remove securing plate -A- for selector lever cable at shift mechanism downward.
- Remove selector lever cable from selector lever.



- Pry off selector lever cable from lever/shift rod using 80-200 pry lever (arrow).
- Remove bracket from transmission.
- Loosen selector lever cable from bracket.
- Pull selector lever cable out of shift mechanism housing without kinking.

Installing

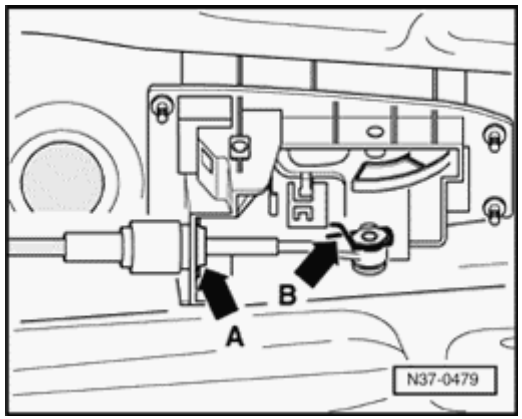
- Selector lever and lever/shift rod in position "P" (park lock must engage).

- Do not bend or kink selector lever cable, lightly grease coupling ring and ball socket before installing

37-43

- Guide selector lever cable into shift mechanism housing.

- Connect selector lever cable to selector lever.

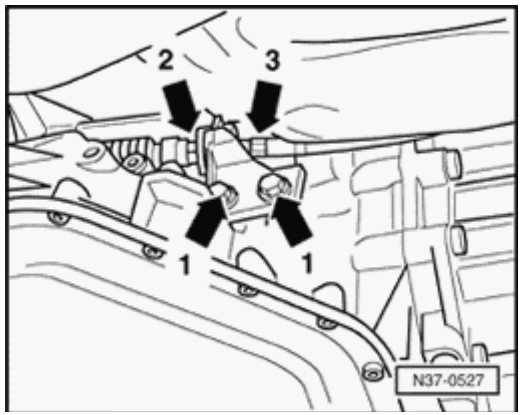


- Press ends of locking clip -B- together and secure selector lever cable.
- Install securing plate -A- for selector lever cable to shift mechanism.

Installation position:

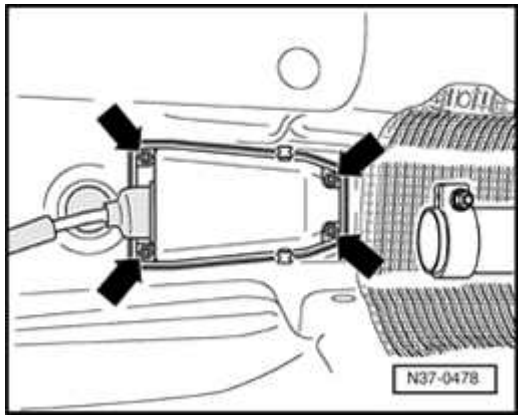
Angled end of securing plate points toward the end of the selector lever cable.

- Connect selector lever cable to bracket by hand.
- Bolt bracket to transmission by hand.
- Press selector lever cable onto lever/shift rod.
- Align selector lever cable in bracket.



- Tighten bracket/transmission (arrows 1) and selector lever cable/bracket (arrow 2) to tightening torque. During this, counterhold at hex socket (arrow 3).

37-44



- Tighten nuts (arrows, 4 pieces) to 10 Nm.
- Check adjustment of selector lever cable and adjust if necessary ⇒ page 37-45 .
- Install heat shield.

All-wheel-drive vehicles

- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.

Continuation for all vehicles

- Connecting front exhaust pipe to rear exhaust system:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26, removing and installing exhaust system.*

- Install front crossmember below exhaust system.

Tightening torques

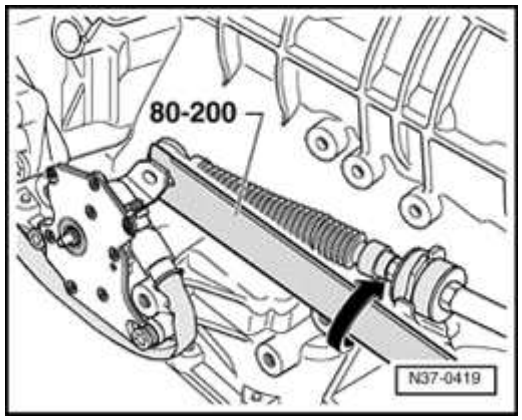
Bracket/selector lever cable to transmission	23 Nm
Selector lever cable to mounting bracket	12 Nm

37-45

Selector lever cable for Tiptronic shift mechanism, checking and adjusting

Checking

- Shift selector lever into position "P".
- Raise vehicle.
- Remove shielding plate/selector lever cable.



- Pry off selector lever cable from lever/shift rod (arrow).
- Shift selector lever from "P" to "2".
  - Shift mechanism and selector lever cable must have freedom of movement during this, if necessary, replace selector lever cable or service shift mechanism.
- Shift selector lever into position "P".
- Shift lever/shift rod to "P", parking lock must engage, both front wheels cannot be turned in one direction.
  - It must be possible to push selector lever cable onto lever/shift rod, if necessary adjust selector lever cable.

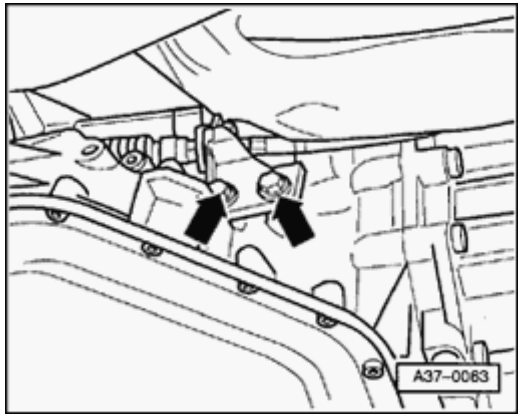
37-46

Adjusting

- Selector lever cable has been loosened from lever/shift rod.

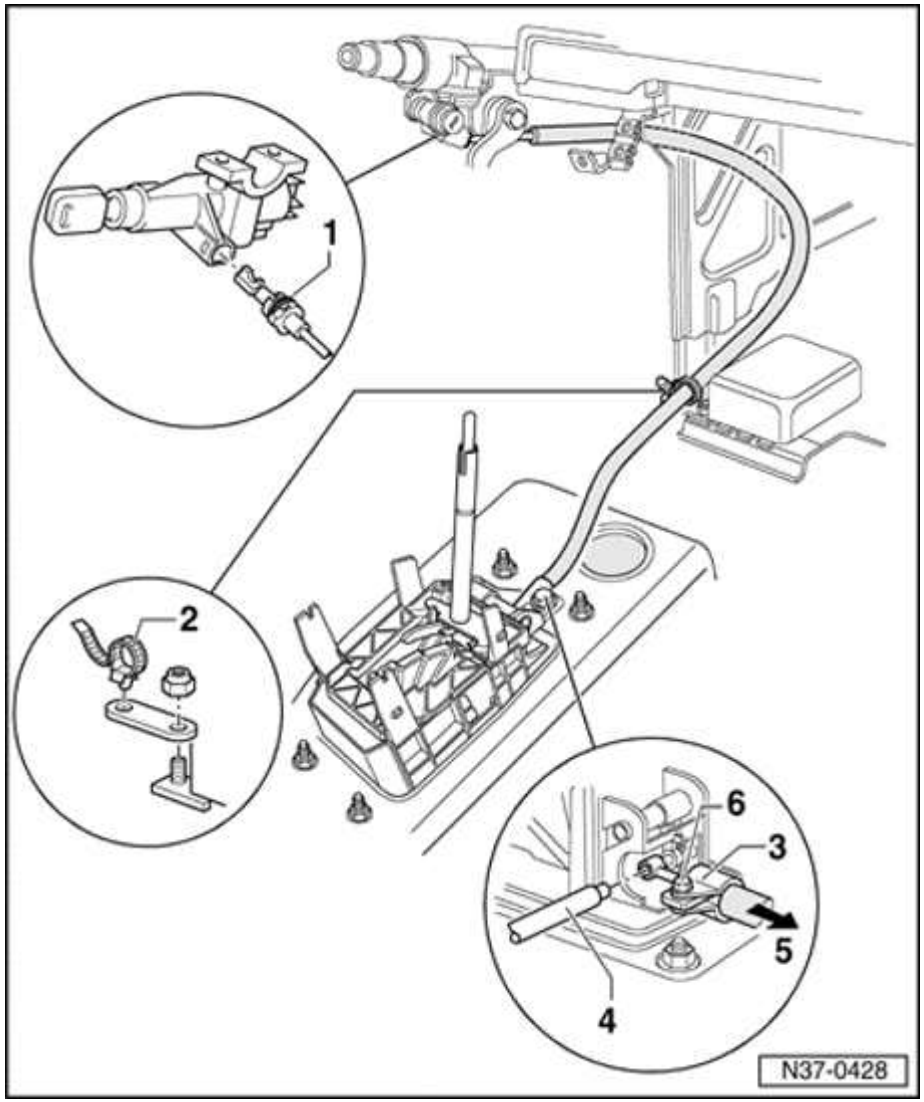
- Shift selector lever into position "P".

- Shift lever/shift rod to "P", parking lock must engage, both front wheels cannot be turned in one direction.



- Loosen mounting bolts (arrows) of bracket at transmission.
- Press selector lever cable onto lever/shift rod.
- Align selector lever cable in bracket.
- Tighten mounting bolts (arrows) of bracket at transmission to 23 Nm.
- Install shielding plate/selector lever cable
- Check shift mechanism ⇒ page 37-2 .

37-47



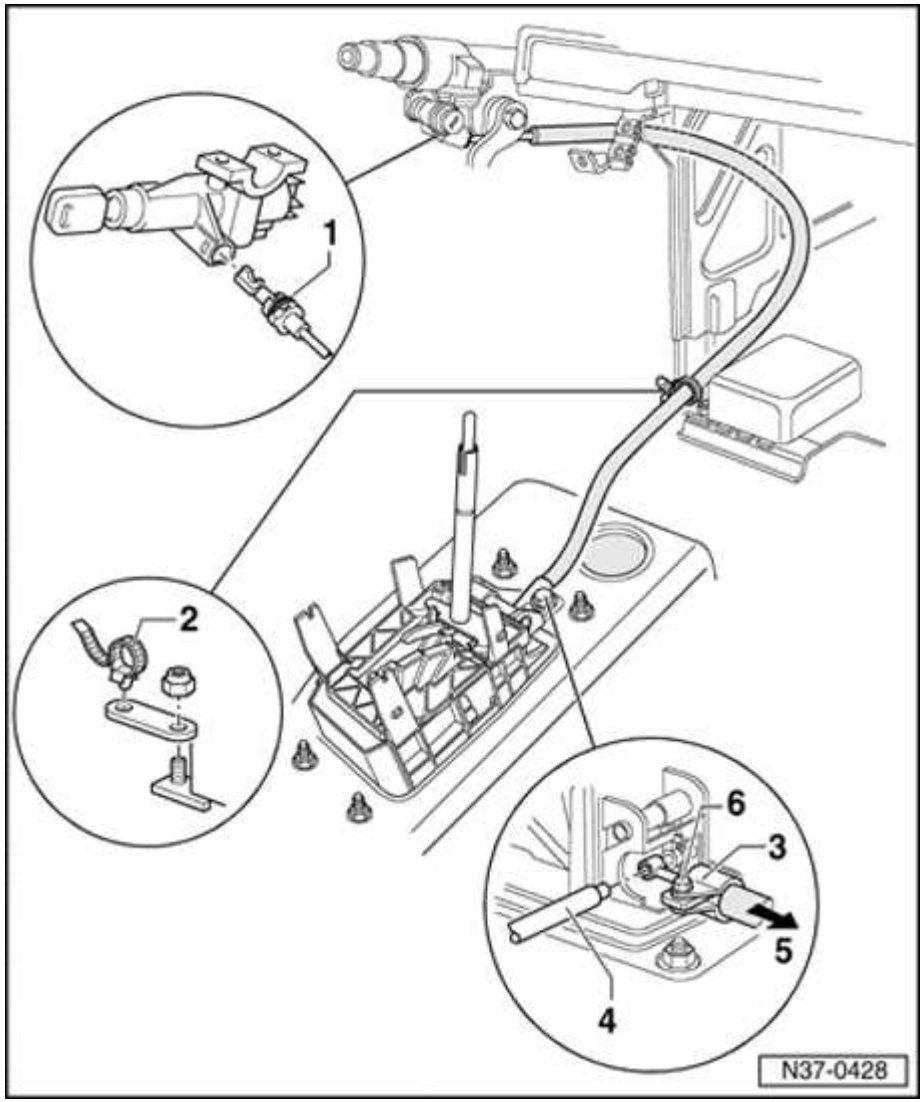
Locking cable for Tiptronic shift mechanism, removing and installing

Removing

- Shift selector lever into position "2".
- Note radio code (for vehicles equipped with coded anti-theft radio).
- Disconnect Ground (GND) strap from battery.
- Selector lever handle, removing ⇒ page 37-22
- Front center console, removing

⇒ *Repair Manual, Body Interior, Repair Group 68; storage compartments/covers; front center console, removing and installing*

37-48

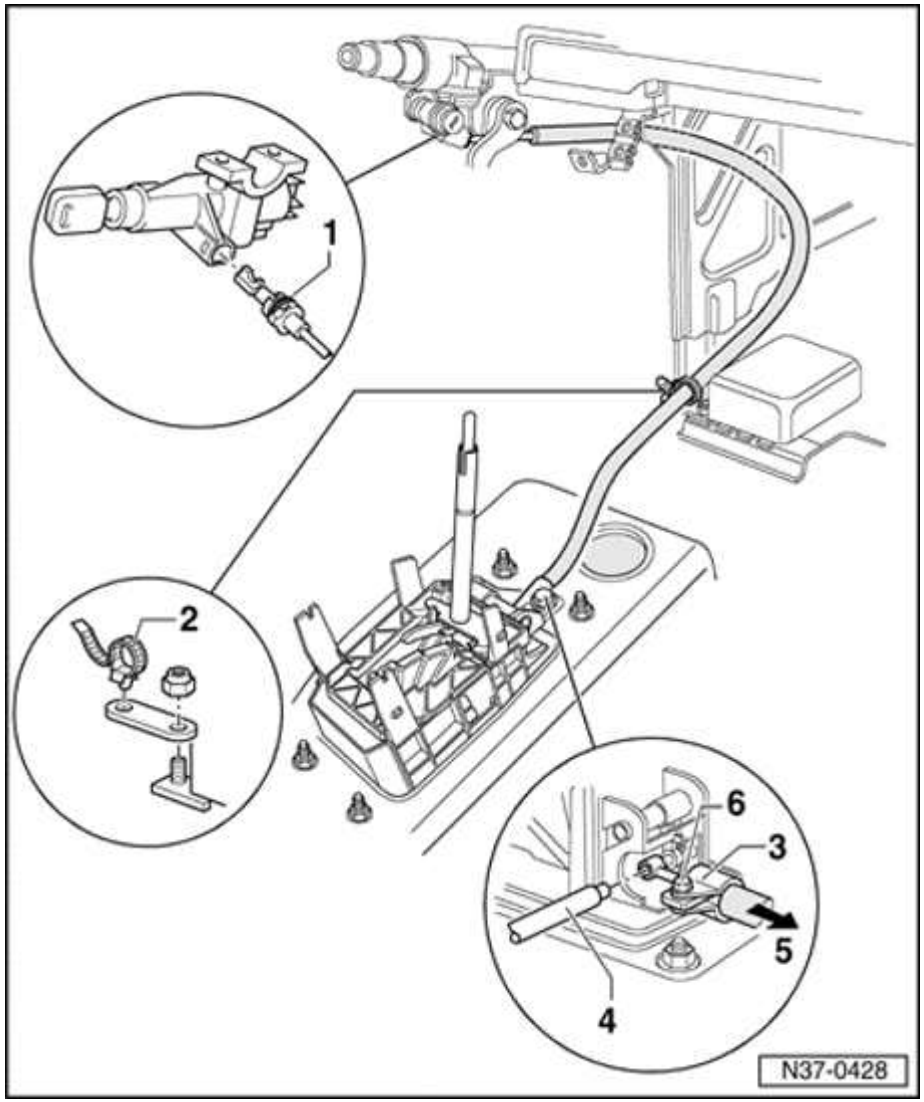


- Remove steering wheel.

⇒ *Repair Manual, Body Interior, Repair Group 69; Airbag; Steering wheel, removing and installing*

- Switch ignition key to driving position (ignition on).
- Shift selector lever into position "P".
- Lift up retaining clip of interlock lever -1- and pull locking cable out of ignition/starter switch.
- Remove cover with guide (selector lever mechanism) ⇒ page 37-5 .
- Unclip locking cable from securing spring at shift mechanism housing, slightly lift up securing spring to do so ⇒ Fig. 1 , ⇒ page 37-21 .
- Loosen and remove locking cable from cable tie -2-.

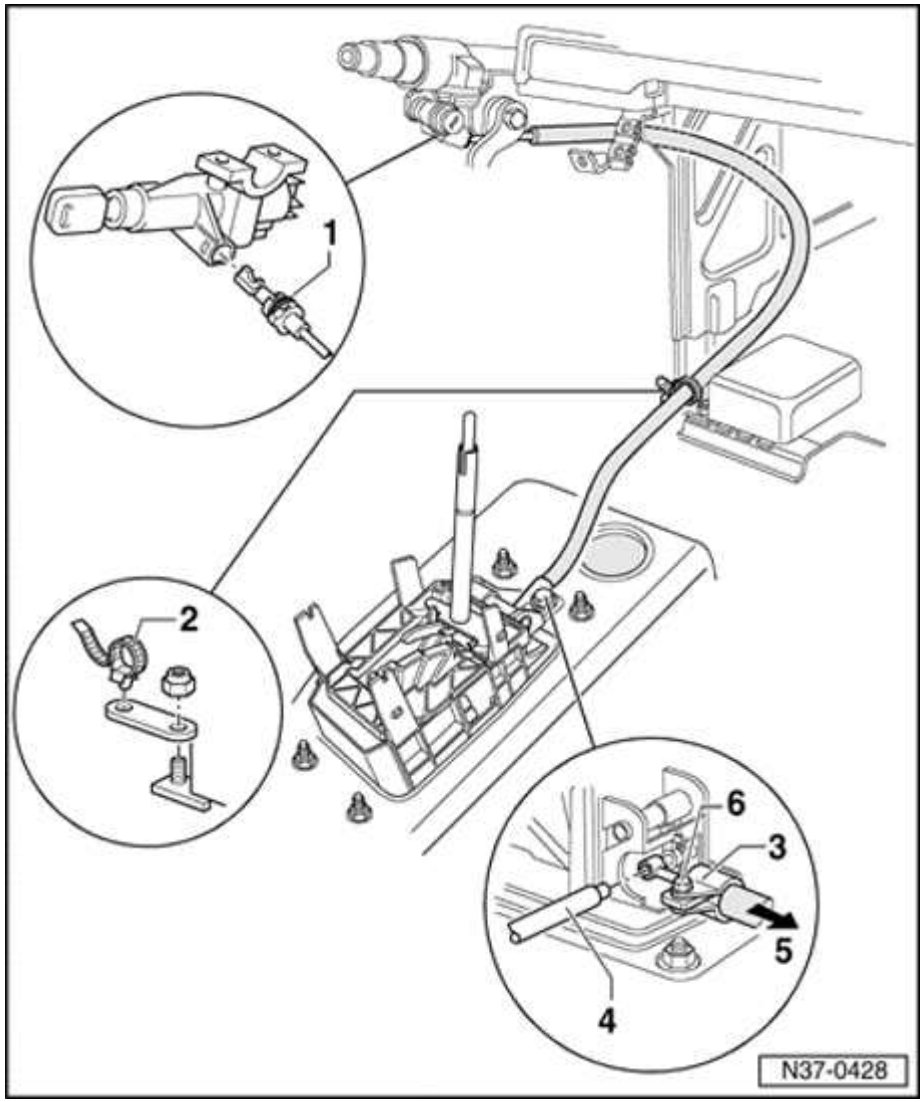
37-49



Installing

- Route locking cable without kinking.
- Switch ignition key to driving position (ignition on).
- Insert locking cable into ignition/starter switch.
- Check locking mechanism of interior lever -1-.
- Secure locking cable to airbag sensor using cable tie -2-.
- Bring ignition/starter switch into locking position (ignition off).
- Shift selector lever into position "P".
- Clip locking cable into securing spring of shift mechanism housing ⇒ Fig. 1 , ⇒ page 37-21 .
- Hook locking cable bracket -3- into shift mechanism and locking coupling ring in lever (for locking cable).

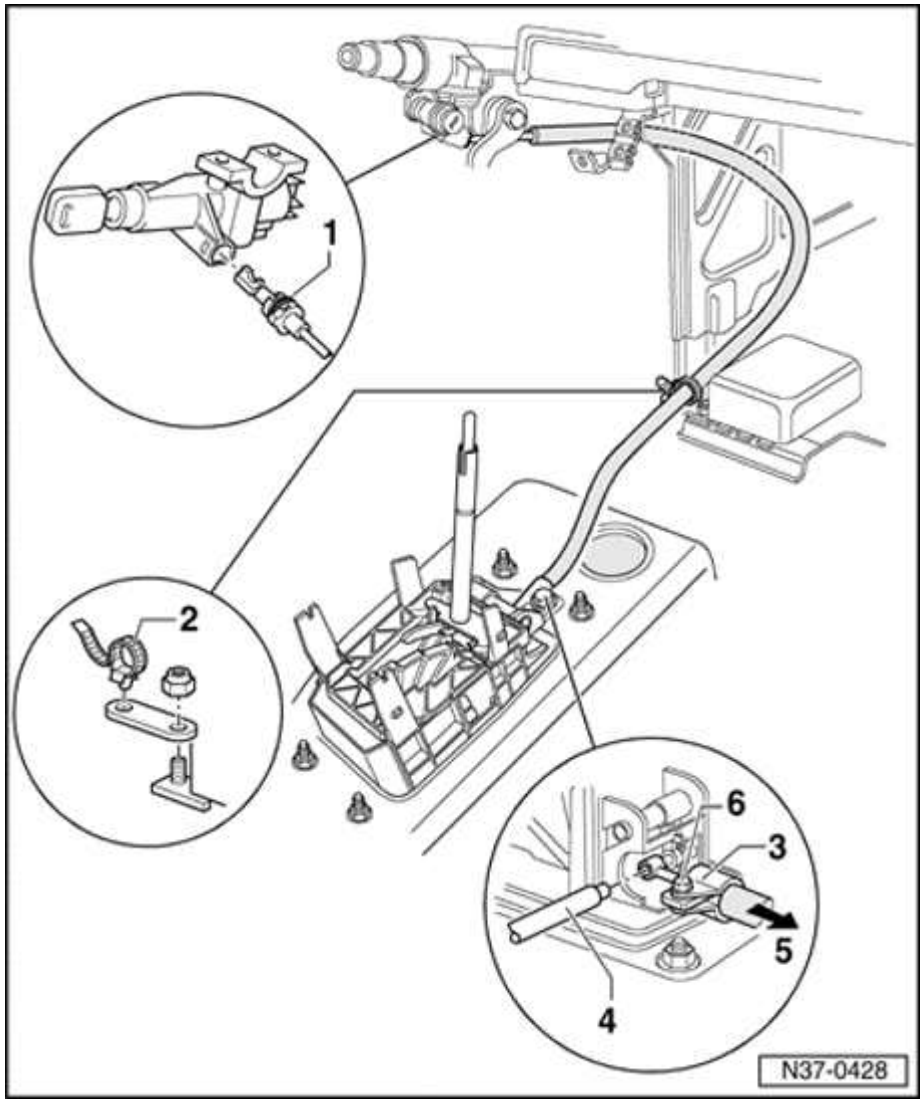
37-50



Adjusting

- Shift selector lever into position "P".
- Loosen bolt -6-.
- It must be possible to slide bracket -3- in direction of arrow -5-.
- Adjust steering column downward.
- Connect 3352 A adjustment pin for shift lock 3 - item 4- between lever (for locking cable) and locking coupling ring.
- Pull locking cable in direction of arrow -5- and tighten bolt -6- to 10 Nm.
- Remove adjusting gauge.
- Check ignition key removal lock after every adjustment of the locking cable ⇒ page 37-1 .

37-51



- Install steering wheel.

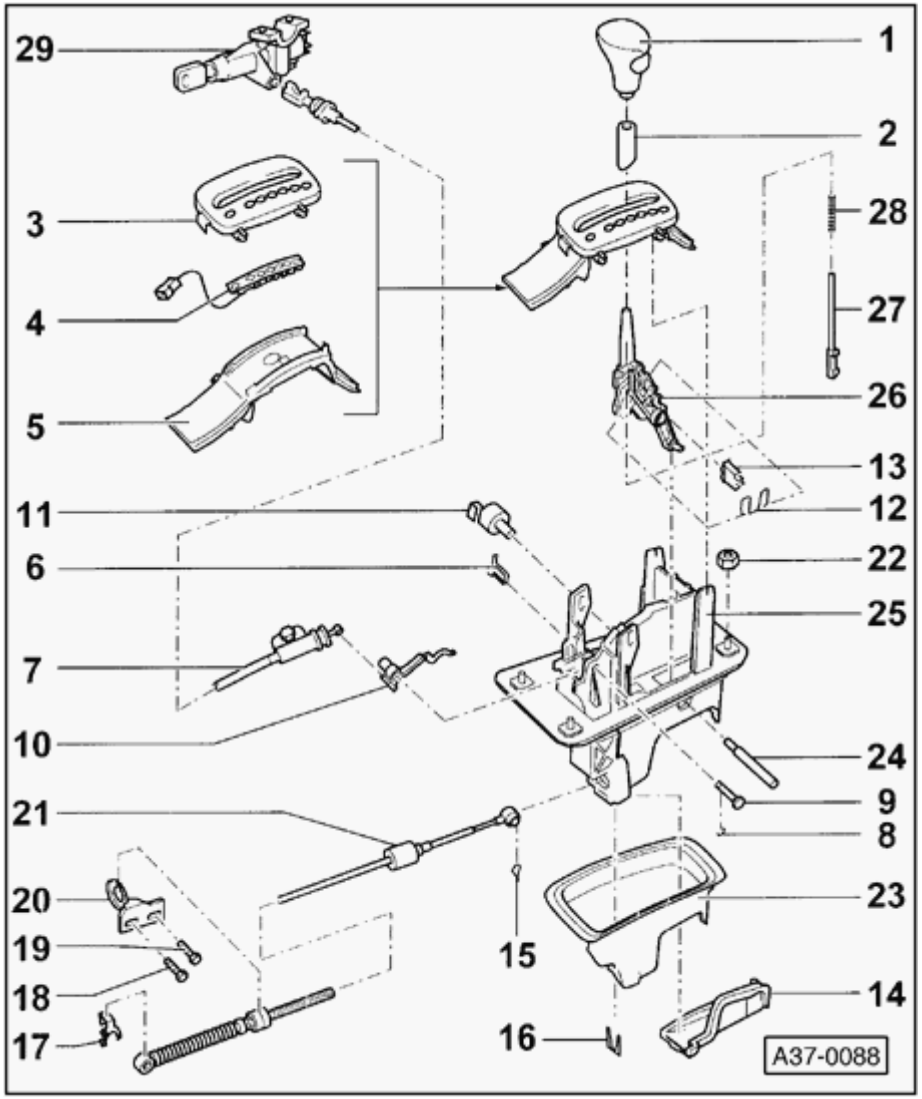
⇒ *Repair Manual, Body Interior, Repair Group 69; Airbag; Steering wheel, removing and installing*

- Front center console, installing

⇒ *Repair Manual, Body Interior, Repair Group 68; storage compartments/covers; front center console, removing and installing*

- Selector lever handle, installing ⇒ page 37-22
- Connect battery Ground (GND) strap.
- For vehicles equipped with coded anti-theft radio, activate code.

37-52



Shift mechanism (without Tiptronic), disassembling and assembling

The Tiptronic shift mechanism is described on ⇒ page 37-6 .

1 - Selector lever handle

- Press casing item 2 downward, pull out button at handle up to stop and pull off handle upward.

2 - Sleeve

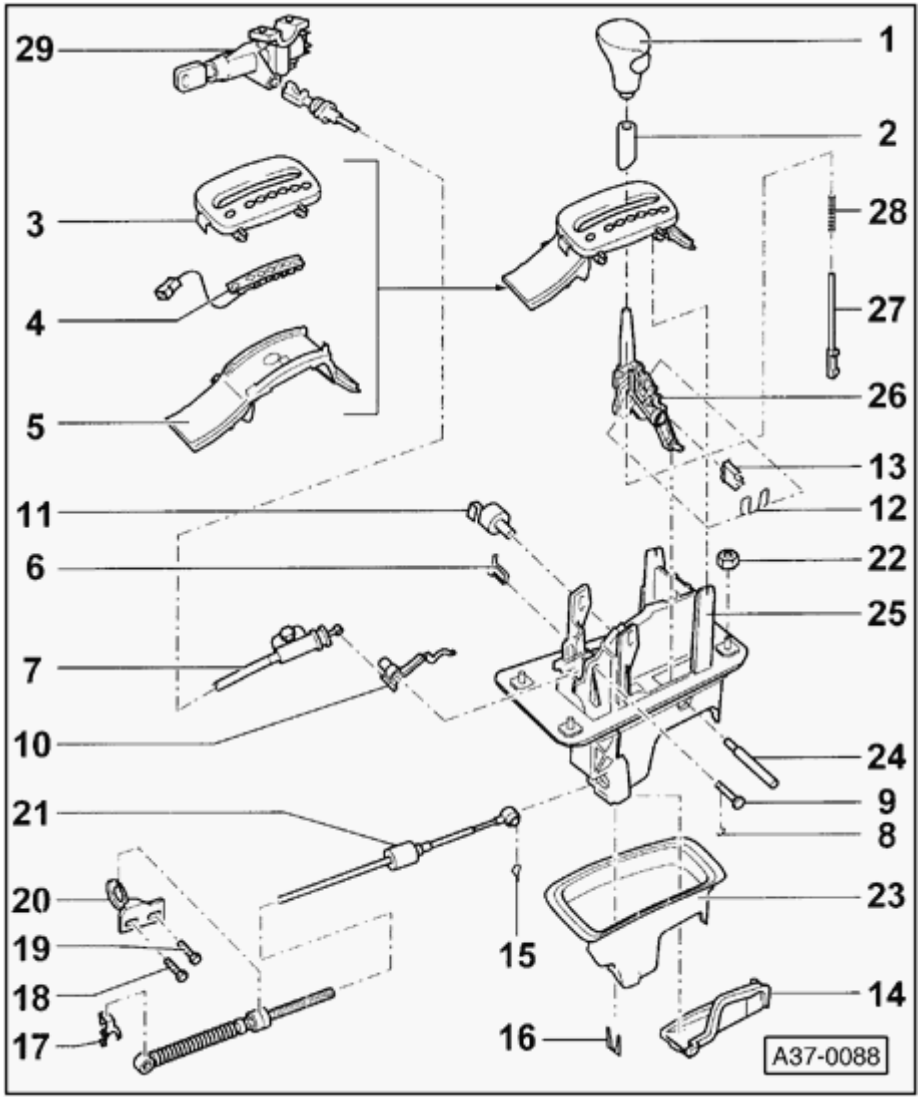
- Engages in the selector lever handle

Note:

For all further work on the shift mechanism, the front center console must be removed.

⇒ *Repair Manual, Body Interior, Repair Group 68; storage compartments/covers; front center console, removing and installing*

37-53



3 - Cover

- With gear display and display for shift lock solenoid
- To remove, disengage retaining tabs for shift mechanism housing
- Remove upward together with item 4 and 5 .

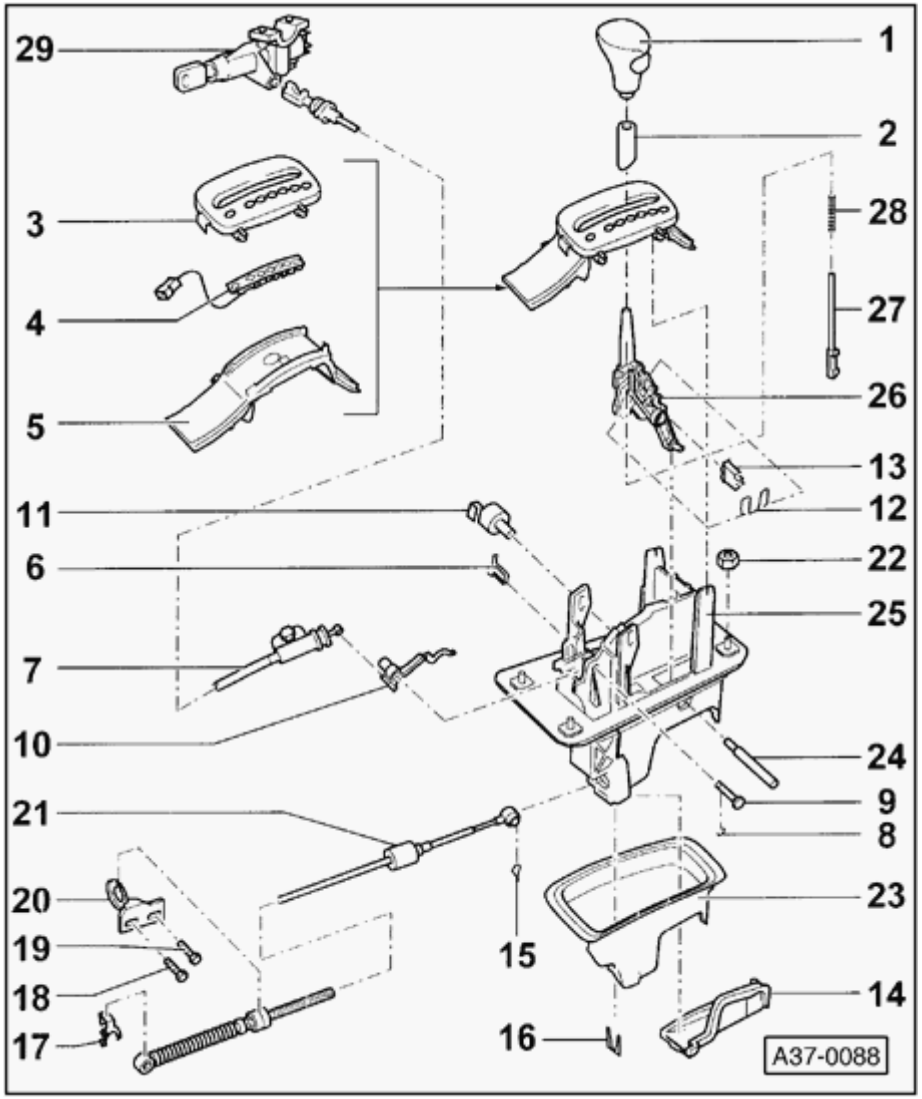
4 - Light track

- With wiring harness and LEDs for base illumination
- Wire routing ⇒ Fig. 4 , ⇒ page 37-61

5 - Guide

- With masking panel and mirror for individual gear display
- Mechanism can be loosened from the cover by disengaging the four retaining tabs at interior.

37-54



6 - Retaining spring

- For locking cable
- Clip into shift mechanism housing ⇒ page 37-47

7 - Locking cable

- Must not be kinked
- Removing ⇒ page 37-47
- Installing and adjusting ⇒ page 37-69

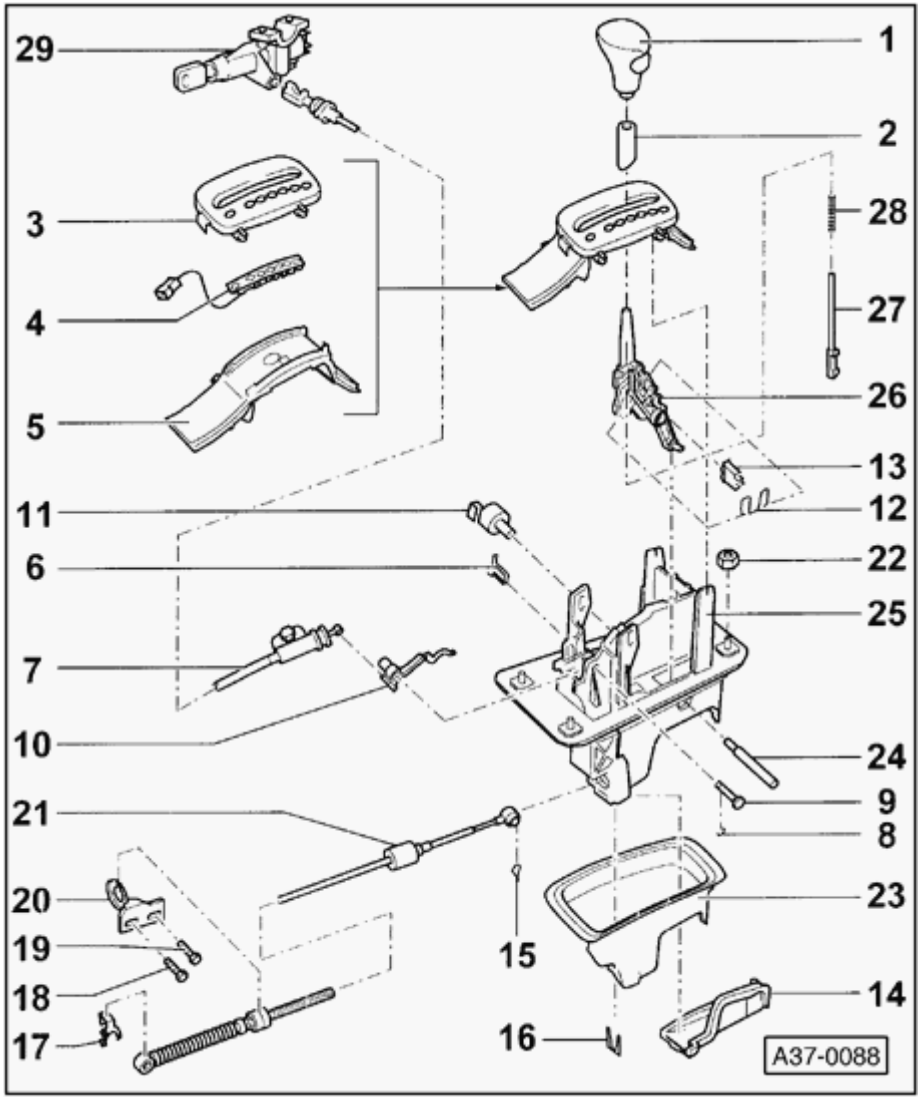
8 - Locking washer

- For pin item 9

9 - Pin

- For lever item 10

37-55



10 - Locking cable lever

11 - Shift lock solenoid -N110-

- Removing and installing ⇒ Fig. 3 , ⇒ page 37-61
- Unclip connector from wiring harness (at center console) item , ⇒ page 37-61
- Can be checked via electrical test and read measuring value block

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01; On Board Diagnostic (OBD); Read measuring value block*

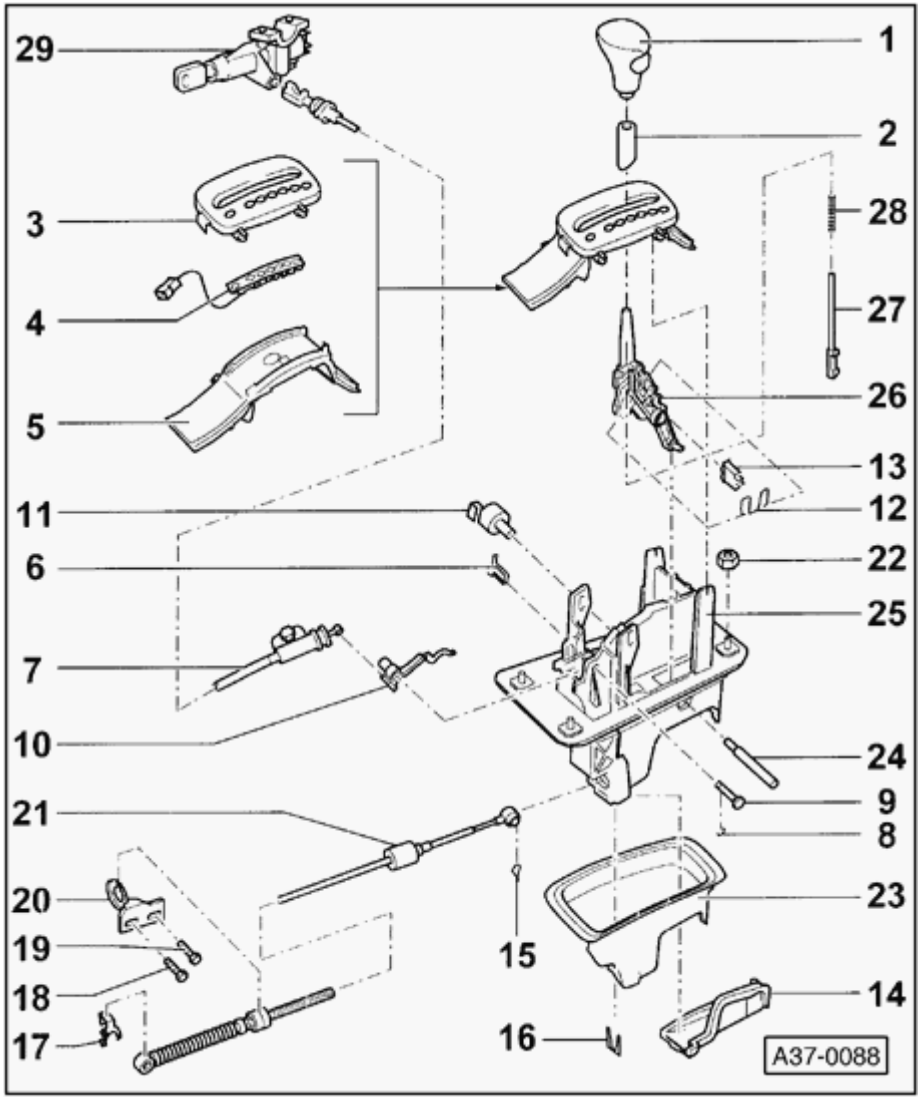
12 - Spring bracket

- Insert both ends into selector lever

13 - Locking segment

- Insert into selector lever together with spring bracket

37-56



14 - Cover

- For shift mechanism housing
- Removing and installing ⇒ Fig. 1 , ⇒ page 37-59

15 - Locking clamp

- For selector lever cable to selector lever

16 - Locking plate

- For selector lever cable to shift mechanism housing ⇒ Fig. 2 , ⇒ page 37-60 item E

17 - Clip

- For selector lever cable to transmission shift lever

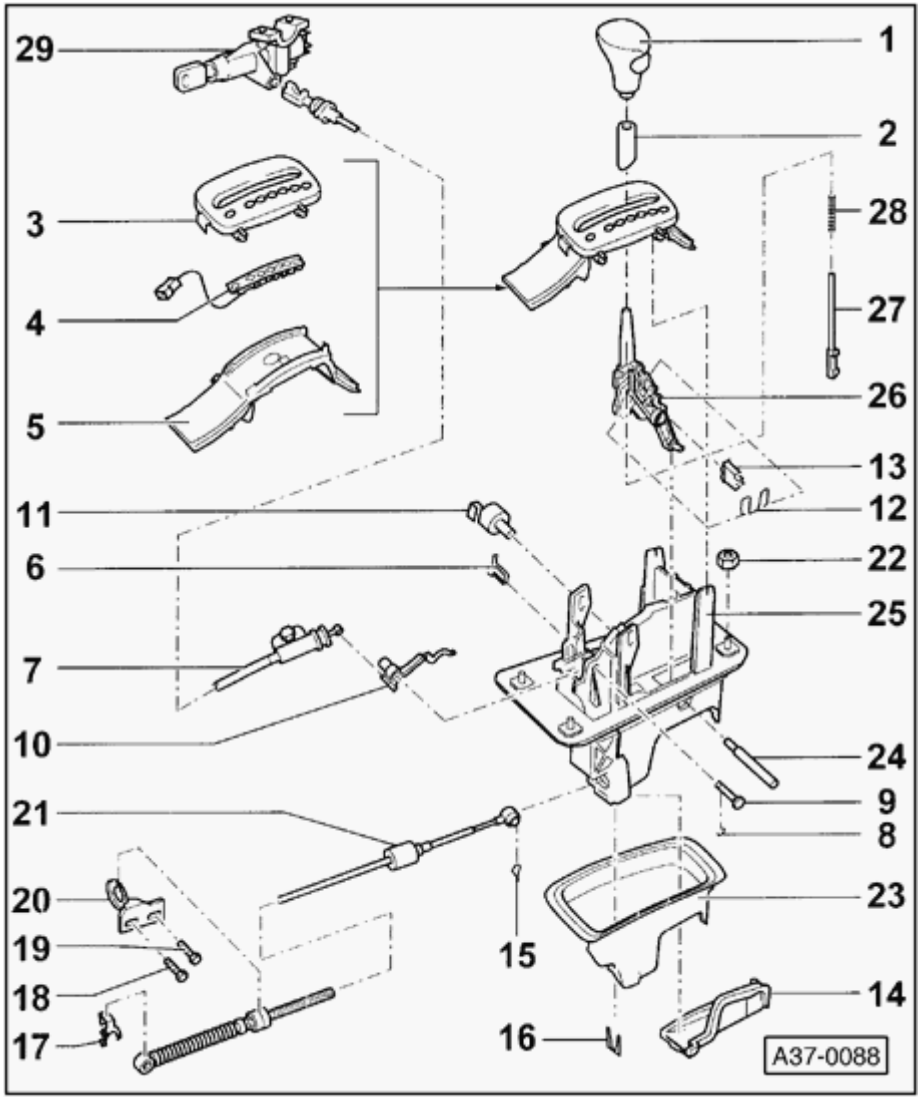
18 - Hex-bolt, 23 Nm

19 - Hex-bolt, 23 Nm

20 - Pivot

- For selector lever cable at transmission

37-57



21 - Selector lever cable

- Removing and installing ⇒ page 37-62
- Adjusting ⇒ page 37-45

Note:

For all further work, shift mechanism must be removed completely from the vehicle.

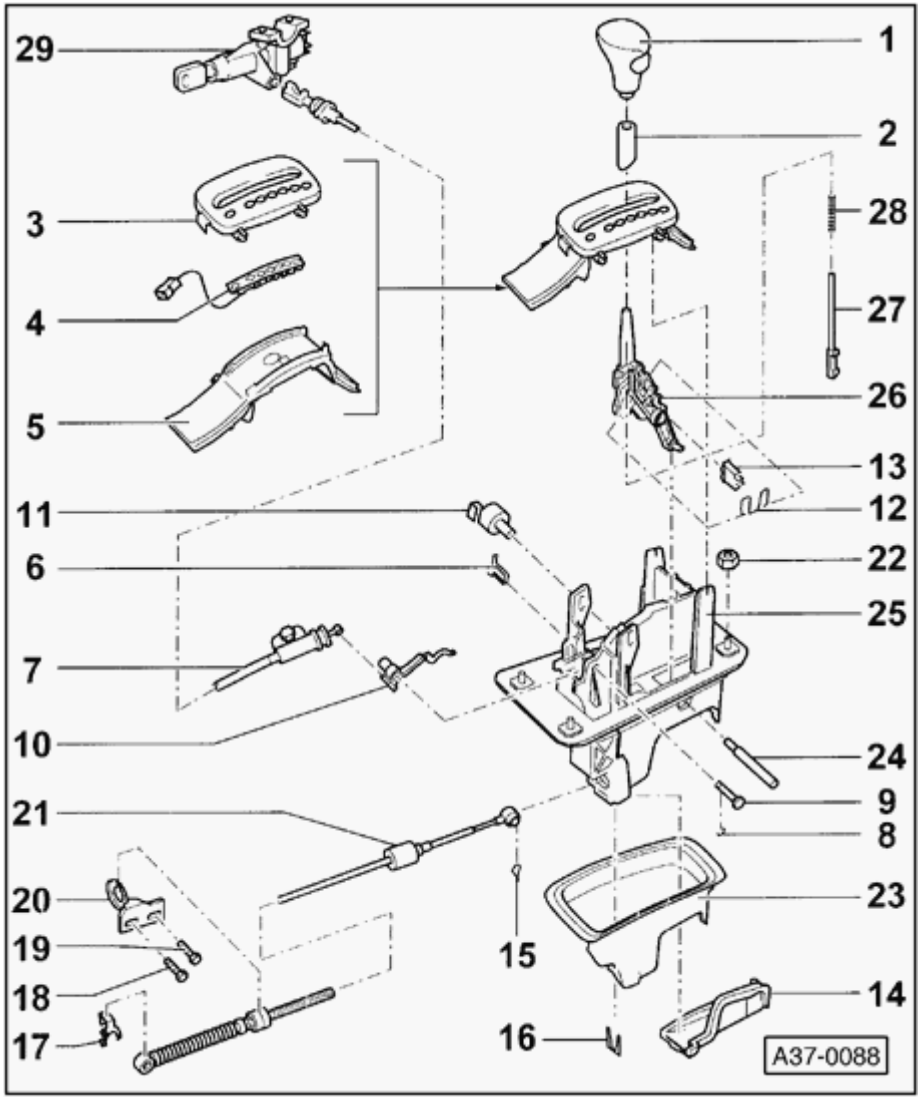
22 - Nut - 9 Nm

- 4x

23 - Rubber housing

- Must only be separated from shift mechanism housing item 25 if damaged or to remove selector lever.
- Installation and installation position ⇒ Fig. 2 , ⇒ page 37-60

37-58



24 - Pivot pin

- Removing: carefully press out using screwdriver

25 - Shift mechanism housing

- Removing and installing ⇒ Fig. 2 , ⇒ page 37-60

26 - Selector lever

27 - Pull-lever

- Insert into selector lever together with spring item 28

28 - Spring

- For pull-lever

29 - Ignition/Starter Switch

37-59

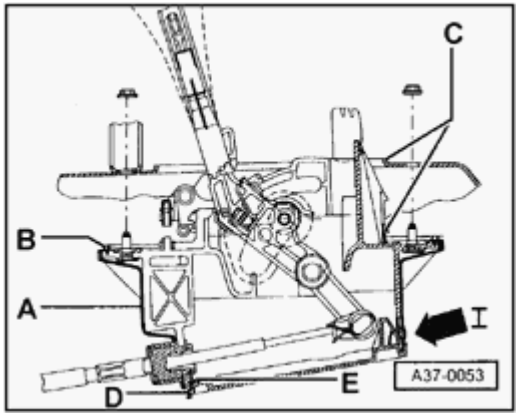


Fig. 1 Cover, removing and installing

Note:

Cover can be removed and installed from below with the shift mechanism installed.

Removing

- Press in direction of (arrow I) and disengage snap-lock to shift mechanism housing.

Installing

- Guide cover into groove -D- and then engage snap-lock.
- Check cover for proper seating and seal.

37-60

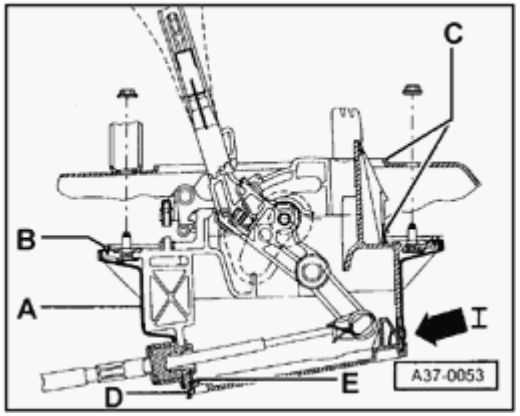


Fig. 2 Shift mechanism housing, removing and installing

- Remove bottom shielding plate and catalytic converter.
- Disconnect selector lever cable from shift mechanism housing.
- Before installing, secure rubber housing -A- to shift mechanism housing.
- Tighten nut - 9 Nm

Note:

- *Rubber housing -A- must seal shift mechanism housing to chassis (sealing lip -B-).*
- *Do not rout any cables between chassis and mounting bracket.*

37-61

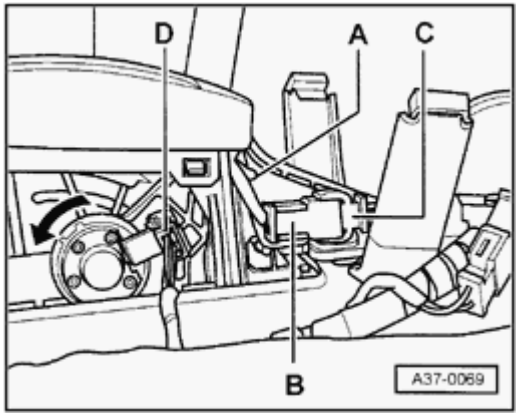


Fig. 3 Shift Lock Solenoid -N110-, removing and installing

- Unclip connector -D- (console wiring harness).
- Turn lift solenoid in direction of arrow approx. 90°.
- Check shift mechanism after removing lift solenoid ⇒ page 37-2

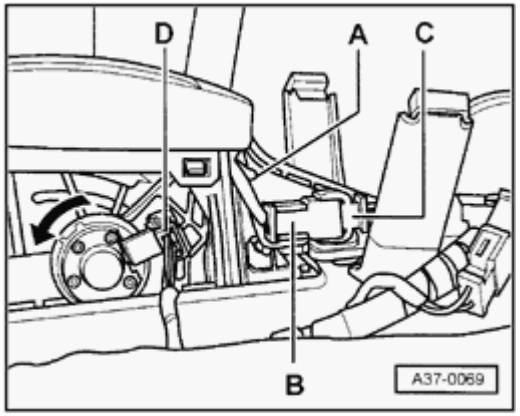


Fig. 4 Route wire for base illumination

- Route wire for base illumination below guide and secure in notch -A- (left/right).
- Clip connector -B- in bracket onto guide.
- Clip in wiring harness connector (console).

37-62

Selector lever cable for shift mechanism (without Tiptronic), removing and installing

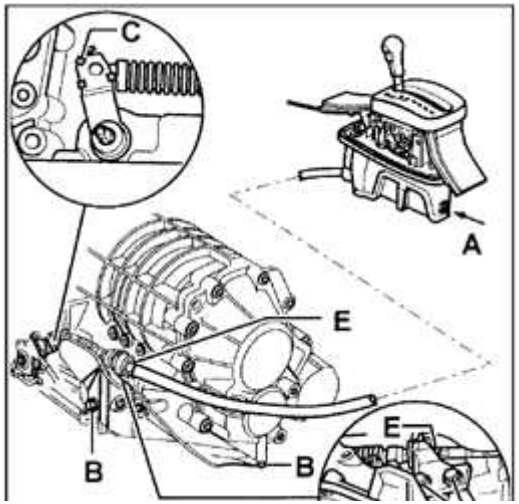
Note:

- *Do not bend or kink selector lever cable, lightly grease coupling ring and coupling ends before installing*

- *Selector lever cable can best be removed in selector lever position "P".*

Removing:

- Remove shielding plate (below shift mechanism) for exhaust system.



- Remove cover:

  Disengage snap lock of cover by pressing in direction of arrow A ⇒ page 37-59 .

- Disengage locking clip by pressing both ends together and pull selector lever cable off selector lever.

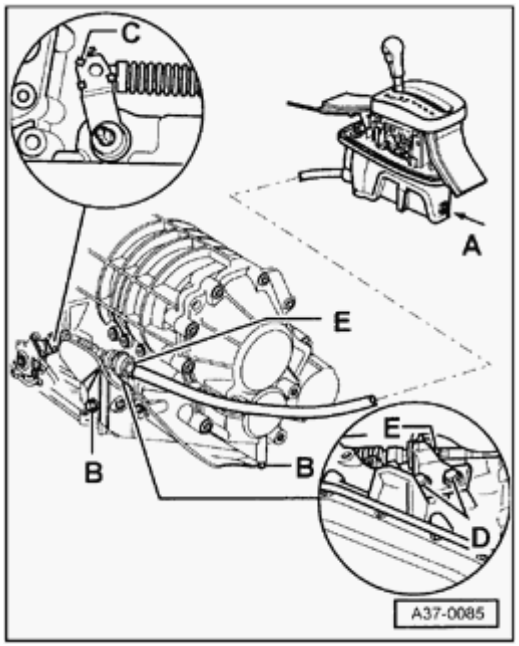
- Pull out securing plate for selector lever cable at shift mechanism housing downward.

- Insert with angled end toward the rear and in groove at selector lever cable ⇒ Fig. 1 , ⇒ page 37-64 .

37-63

- Pull selector lever cable out of shift mechanism housing.

- Remove shielding plate for selector lever cable (item B).



- Press retaining clip off of lever/shift lever (item C).
- Press ball socket of selector lever cable off of lever/shift rod.
- Loosen bracket from transmission (item D).
- If necessary, loosen selector lever cable from bracket (item E).

Installing

- Selector lever and lever/shift rod in position "P" (park lock must engage).
- Installation is the reverse order of removal.
- Lightly grease coupling ring and ball socket of selector lever cable.
- Selector lever cable, checking and adjusting ⇒ page 37-45 .

37-64

Tightening torques:

Components	Tightening torques
Selector lever cable to mounting bracket	12 Nm
Bracket to right transmission mount	23 Nm
Shielding plate to transmission, M8	23 Nm

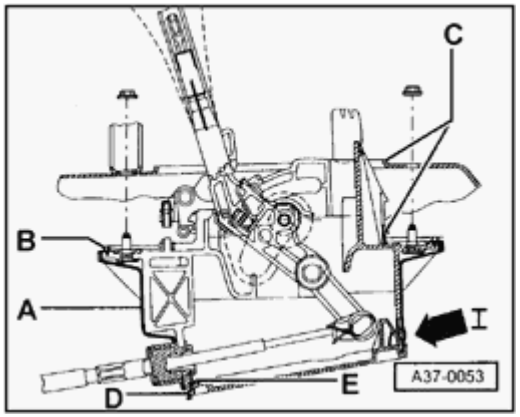


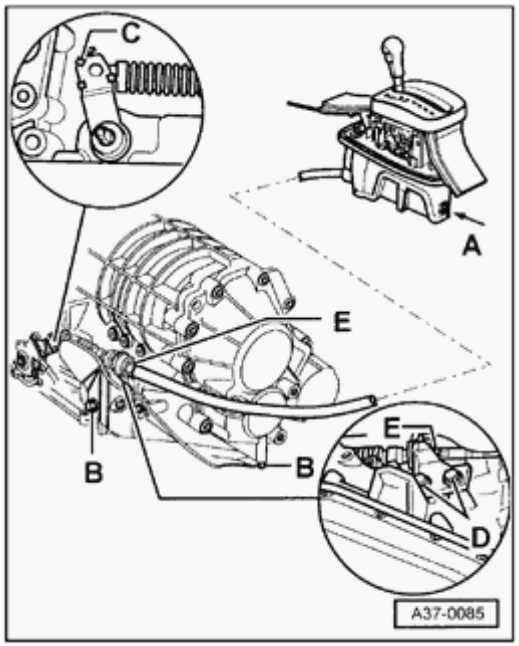
Fig. 1 Installing securing plate

- Installation of the securing plate (item E).

  Insert with angled end toward rear.

37-65

Selector lever cable for shift mechanism (without Tiptronic), checking and adjusting



Checking:

- Removing retaining clip -C- for selector lever cable at lever/shift lever ⇒ page 37-62 .
- Press selector lever cable off of lever/shift lever.
- Shift selector lever from "P" to "2".

• Shift mechanism and selector lever cable must have freedom of movement during this, if necessary, replace selector lever cable or service shift mechanism.

- Switch selector lever to "P".
- Shift lever/shift lever to "P" (last position, shift lock solenoid must engage).

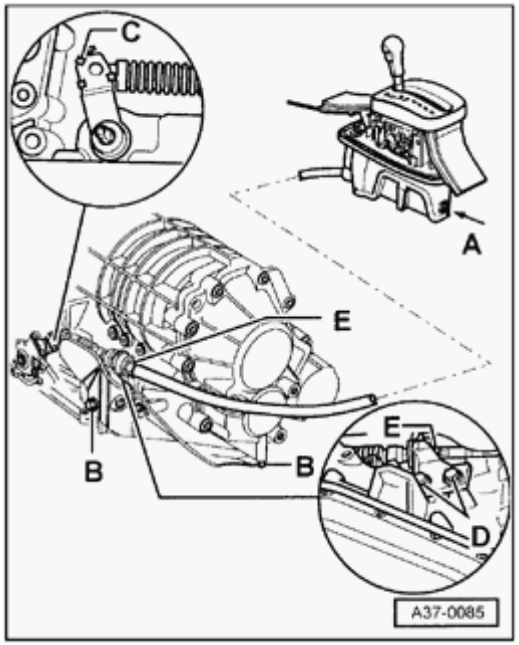
• It must be possible to push selector lever cable onto lever/shift rod, if necessary adjust selector lever cable.

37-66

Adjusting

- Place selector lever in position "P".

- Shift lever/shift lever to "P" (last position, shift lock solenoid must engage).



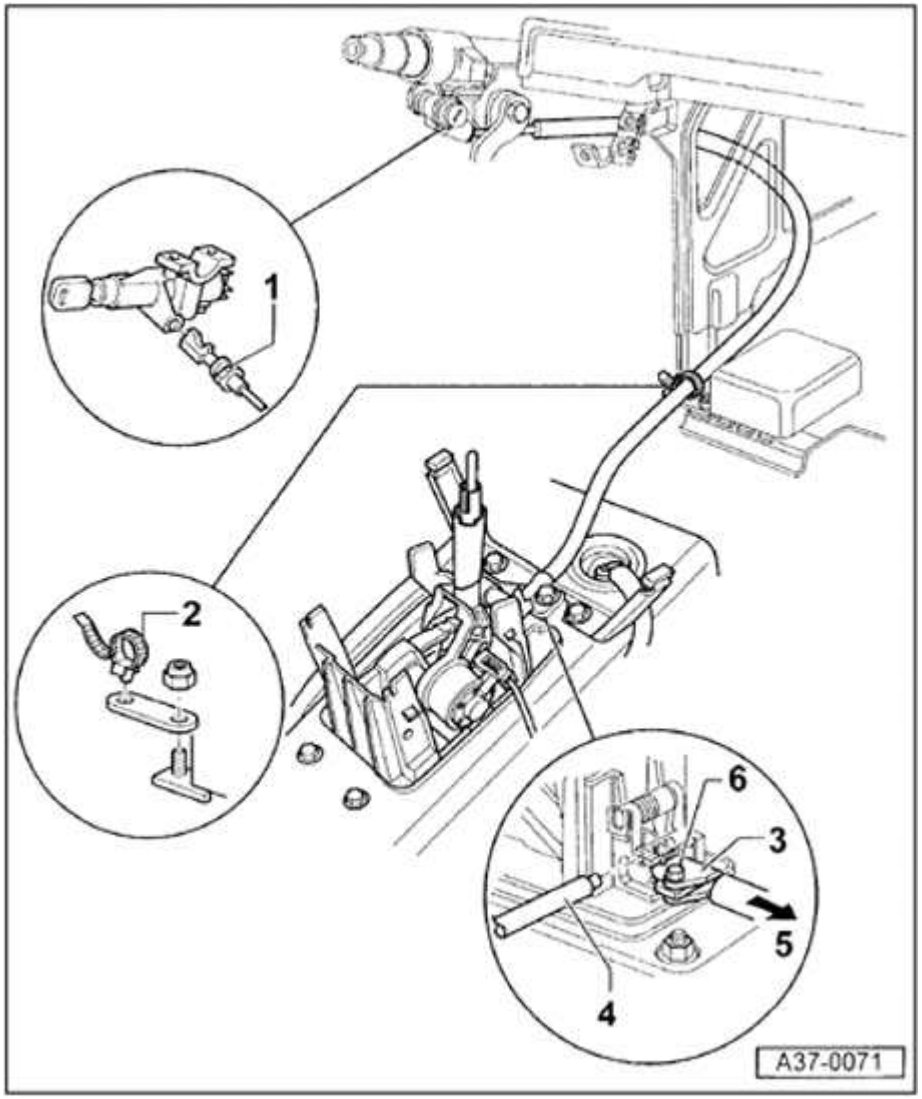
- Slightly loosen mounting bolt at bracket to transmission.

- Check freedom of stress of selector lever cable, if necessary eliminate stress.

- Tighten mounting bolt of bracket to 23 Nm.

- Check shift mechanism ⇒ page 37-2 .

37-67



Locking cable for shift mechanism (without Tiptronic), removing and installing

Note:

- *Locking cable must not be kinked.*

Removing:

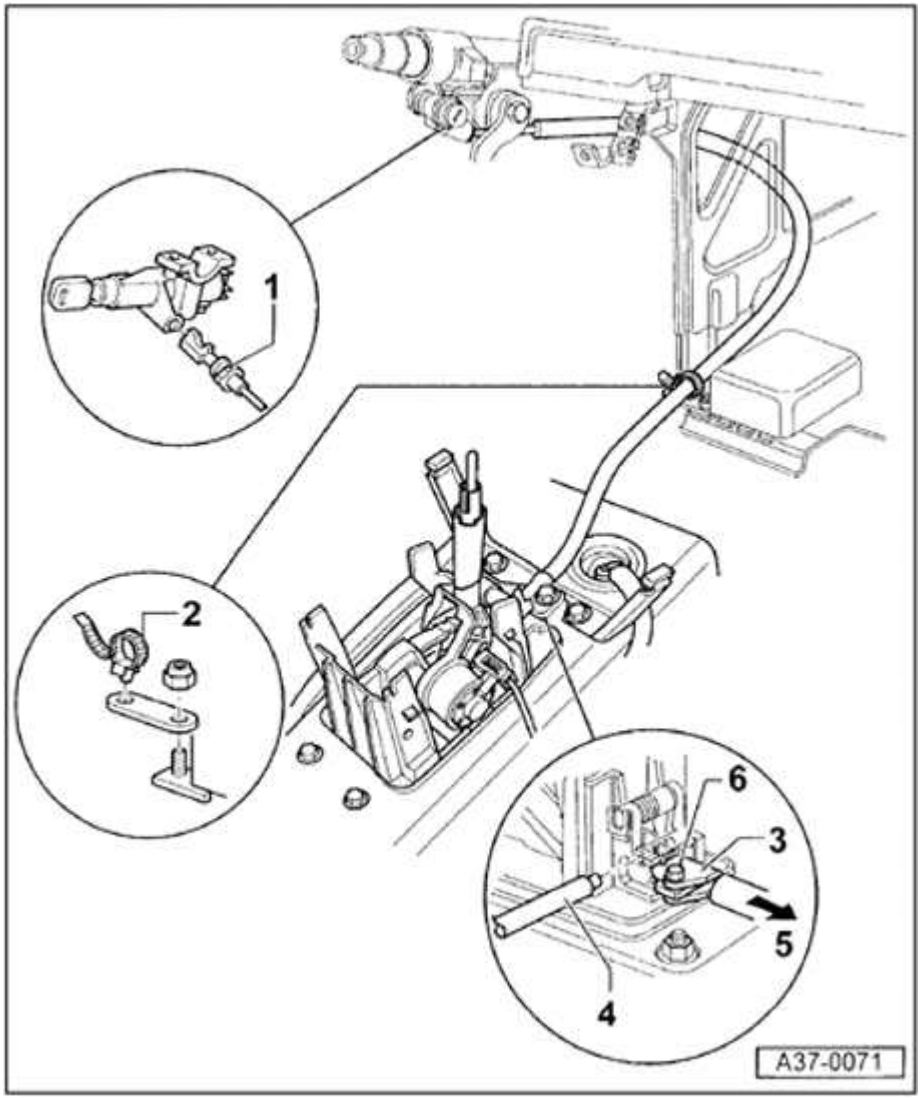
- Disconnect Ground (GND) strap from battery.
- Remove driver-side storage compartment below steering wheel.

⇒ *Repair Manual, Body Interior, Repair Group 68; storage compartments/paneling; removing storage bin on driver's side*

- Remove steering column switch.

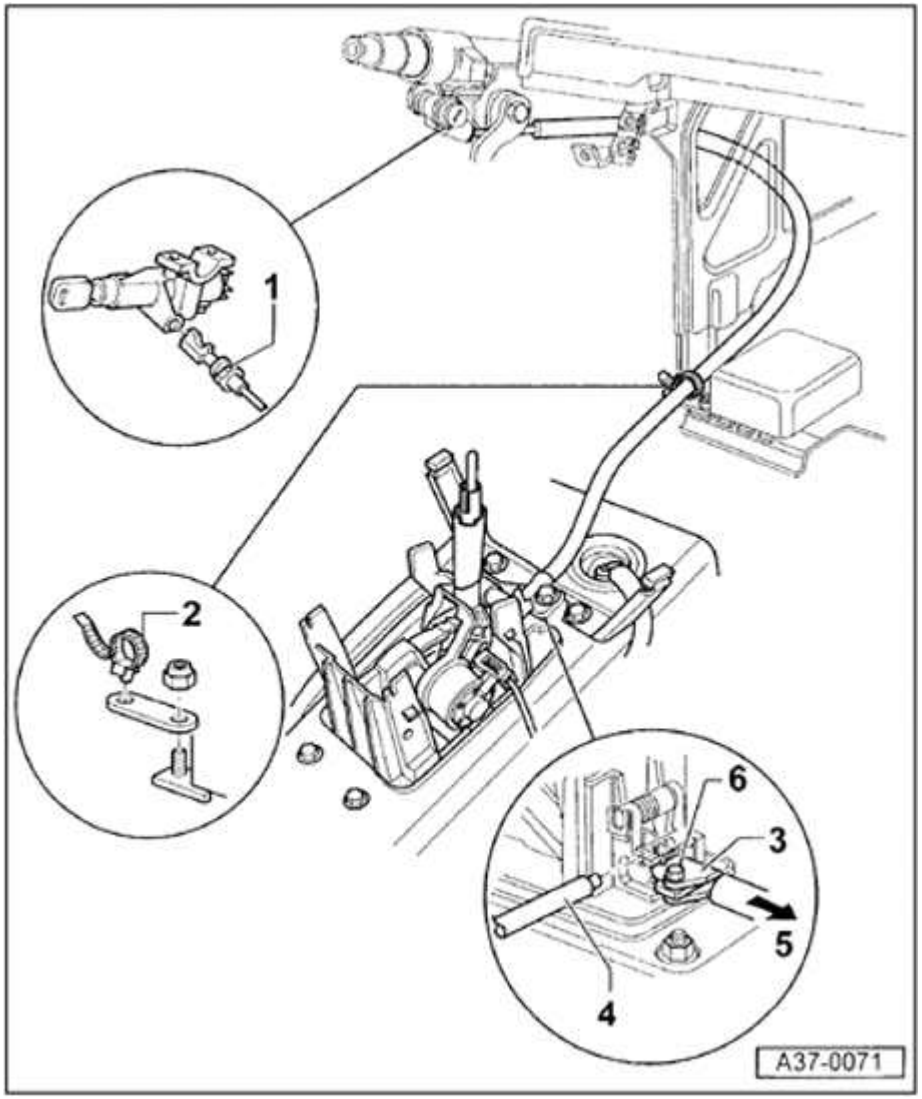
⇒ *Repair Manual, Electrical Equipment, Repair Group 92; Steering column switches, servicing; Steering column switches, removing and installing*

37-68



- Set ignition/starter lock in "Drive" position.
- Shift selector lever into position "P".
- Lift up locking bracket -1- and pull locking cable out of ignition/starter lock.
- Remove cover with guide (selector lever mechanism) ⇒ page 37-5 .
- Unclip locking cable from securing spring at shift mechanism housing, slightly lift up securing spring to do so.
- Loosen cable tie -2- and remove locking cable.

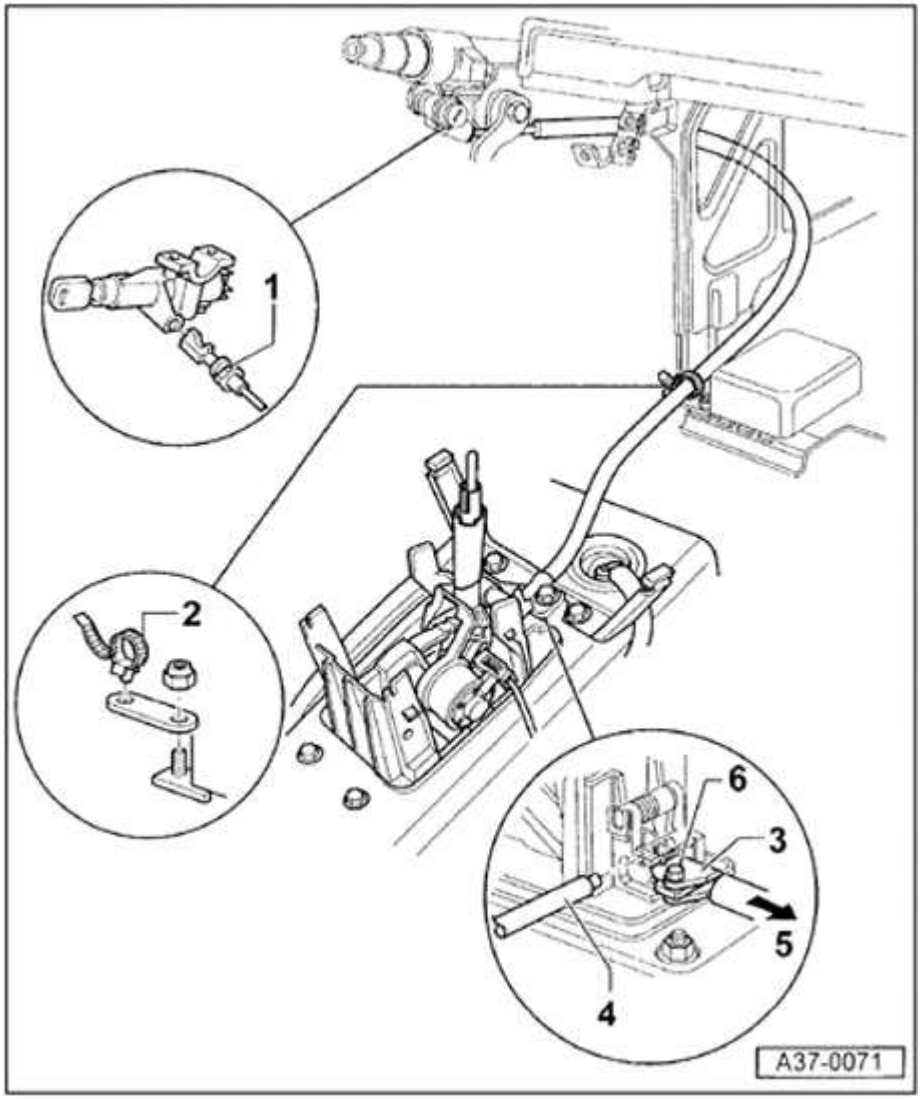
37-69



Installing and Adjusting

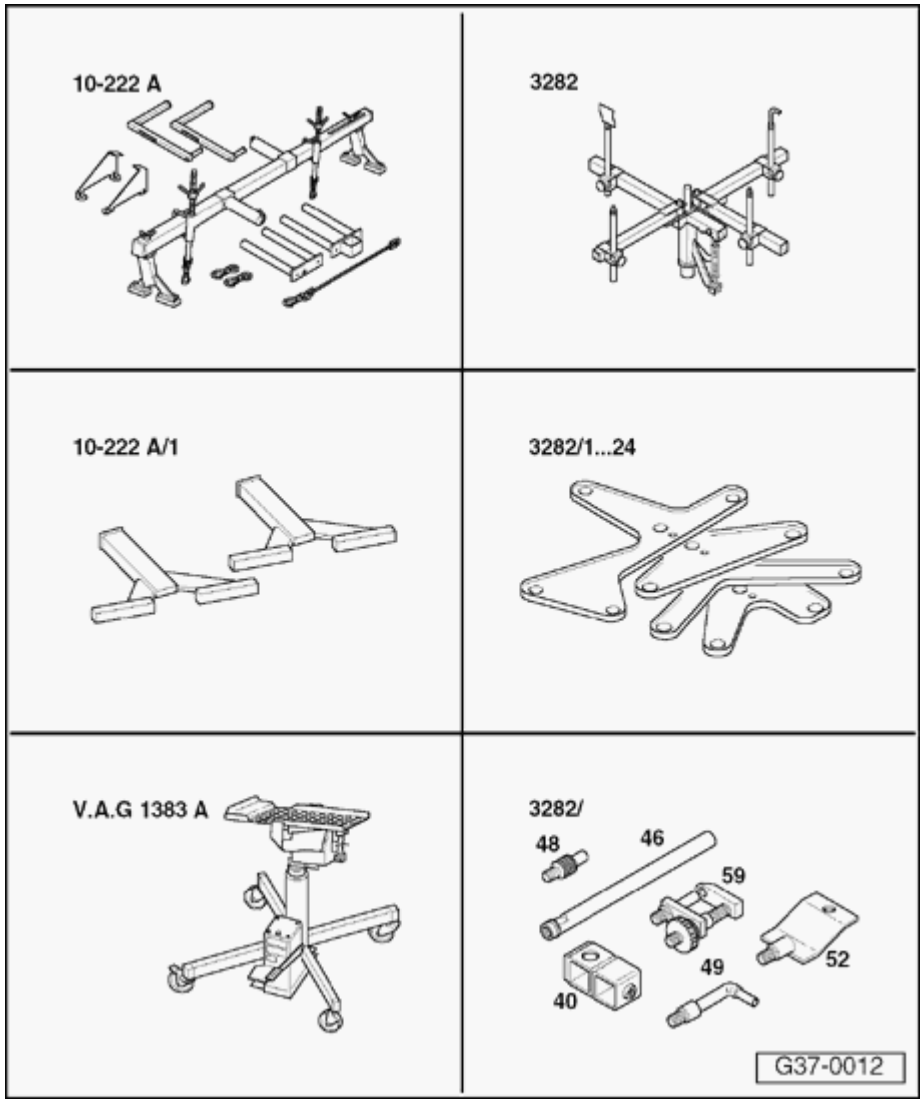
- Installation is the reverse of removal.
- Install locking cable without kinking and secure at indicated position using cable tie -2-.
- Adjust steering column rearward/downward.
- Check locking mechanism of interior lever -1-.
- Slightly loosen bolt -6-.
- It must be possible to slide bracket -3- in direction of arrow -5-.
- Make sure securing spring is correctly seated in shift mechanism housing.
- Hook locking cable bracket -3- into shift mechanism and locking coupling ring in lever (for locking cable).

37-70



- Connect 3352A adjustment pin for shift lock 3 - item 4- between lever (for locking cable) and locking coupling ring.
- Pull locking cable in direction of arrow -5- and tighten bolt -6- to 8 Nm.
- Check locking cable after every new adjustment of the locking cable ⇒ page 37-1 .

37-71



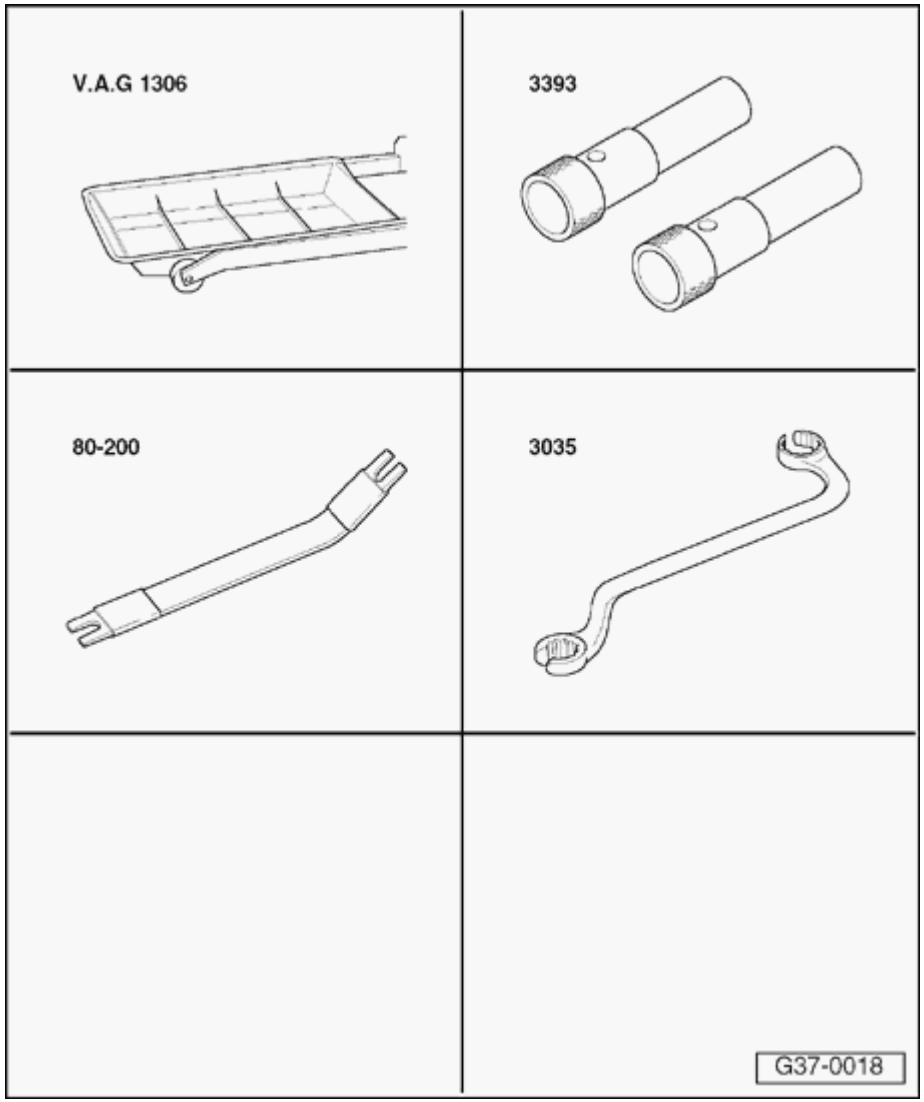
Transmission, removing and installing

Removing

Prepare the following special tools and test equipment for use:

- 10-222 A engine support bridge
- 10-222 A/1 bracket for engine
- 10-222 A/3 engine support adapter
- V.A.G.1383A lift
- 3282 transmission support
- 3282/19 adjustment plate
- 3282/48 adapter
- 3282/52 - adapter (3 pcs.)

37-72



- VAG1306 drip tray
- 80-200 pry lever
- 3035 injector line wrench
- 3393 Testing Mandrels
- V175 special tool (nut)

37-73

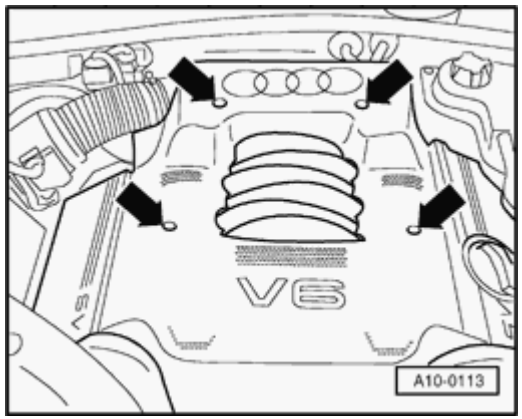
Additional information

- Repair Manual, Suspension, Wheels, Steering
- Repair Manual, Electrical Equipment
- Repair Manual, Engine Mechanical

- Note radio code (for vehicles equipped with coded anti-theft radio).

- Disconnect Ground (GND) strap from battery.

For 6 cylinder gasoline engines except for 2.7 Liter 5V turbo engine:

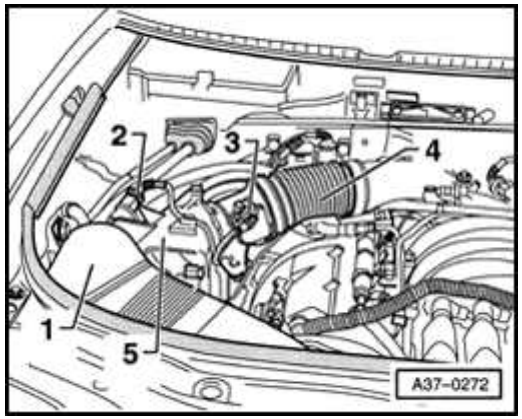


- Remove engine cover (arrows).

37-74

All except 2.7 Liter 5V turbo engine:

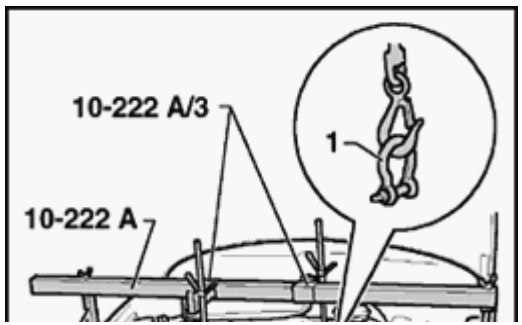
- Remove cover above air filter housing.



- Remove air guide -1- between air filter housing and lock carrier.
- Disconnect connector for Evaporative Emission (EVAP) canister purge regulator valve -2-, and remove valve from bracket. Disconnect connector -3- at Mass Air Flow (MAF) sensor.
- Remove intake air duct -4- from intake manifold.
- Remove upper part of air filter housing -5-.
- Unbolt engine coolant expansion tank and lay aside.
- Remove Heated Oxygen Sensor (HO2S) from front exhaust pipes (left and right).
- Remove upper securing nuts from front exhaust pipes (left and right).

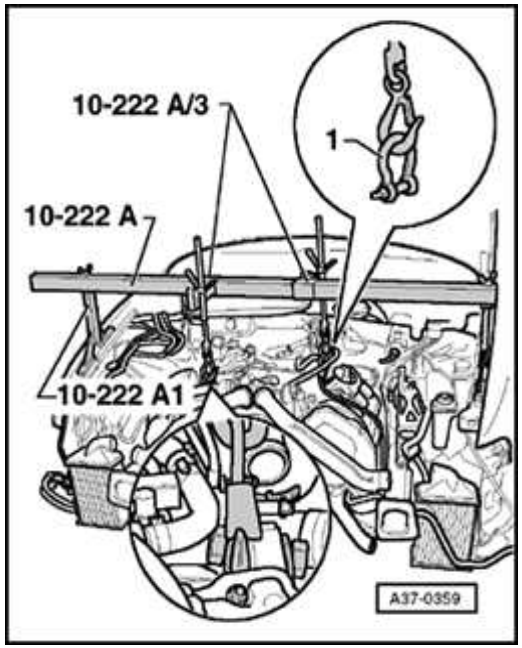
For all 6 cylinder engines:

- Assemble both 10-222A/3 engine support adapters for front and rear spindles on support bar.



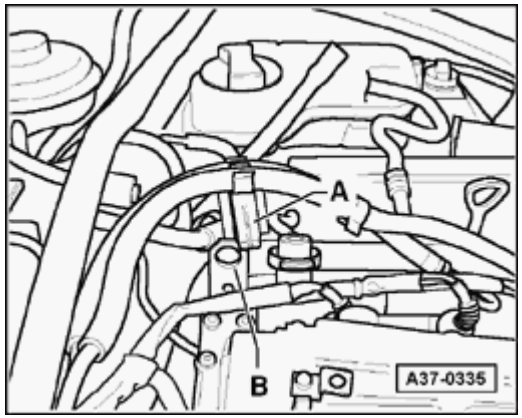
- Set 10-222A engine support bridge onto the fender mounting flanges using 10-222A/1 brackets.

37-75



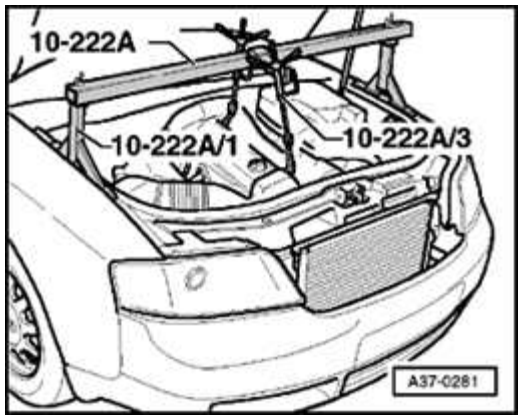
- Hang both spindles on the adapters.
- Secure engine to spindles. To do so, additionally use a shackle -1- at the rear side of the engine to avoid damage.

For 4 cylinder engines:



- Disconnect connector -A- from bracket -B-.

37-76



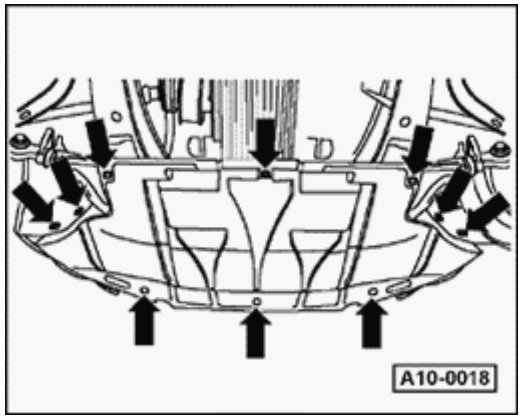
- Mount 10-222A/3 adapter for spindle at front of support.

- Install 10-222A engine support bridge with 10-222A/1 brackets and support engine/transmission in this position.

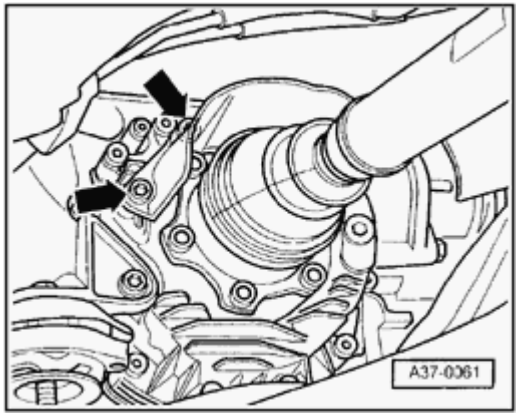
All:

- Take up weight of engine/transmission assembly on spindles.
- Tighten the rear spindle less, to enable later lowering at rear.
- Raise vehicle.
- Remove front wheels.

37-77



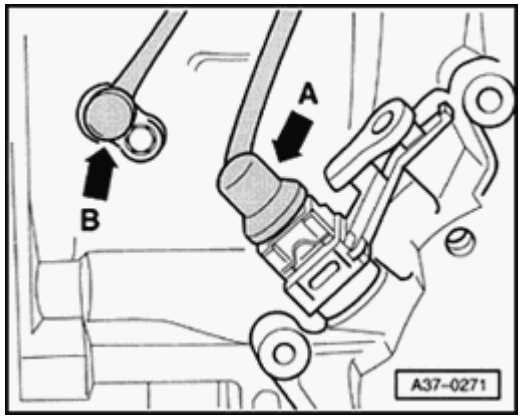
- Remove sound-deadening pan.



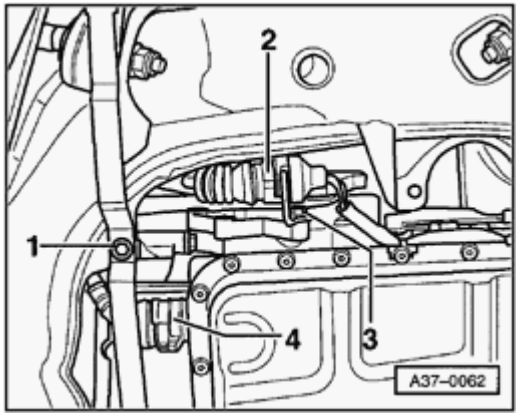
- Remove left and right heat shields for drive axles (arrows).
- Disconnect drive axles from transmission drive flanges.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

37-78



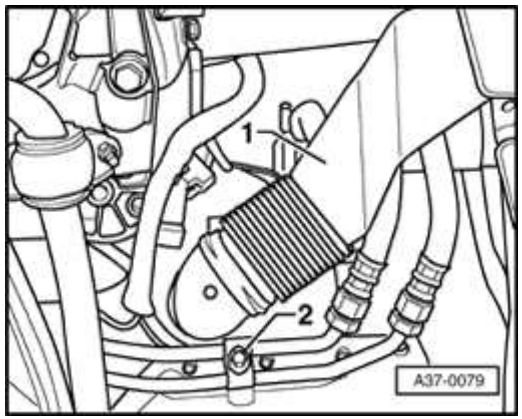
- Disconnect engine speed (RPM) sensor -G28- (arrow B) from transmission at front left (if installed).
- Remove connector for speedometer (arrow -A-) from transmission.



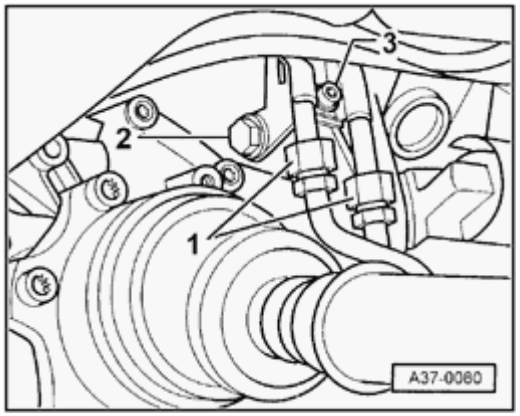
- Remove noise insulation bracket -1-.
- Swing securing lever -4-, disconnect connector for transmission wiring harness.
- Disconnect connector -2- of wire for multi-function switch.
- Unbolt bracket -3- for harness connector.

37-79

For 6 cylinder engines except for 2.7 Liter 5V turbo engine:

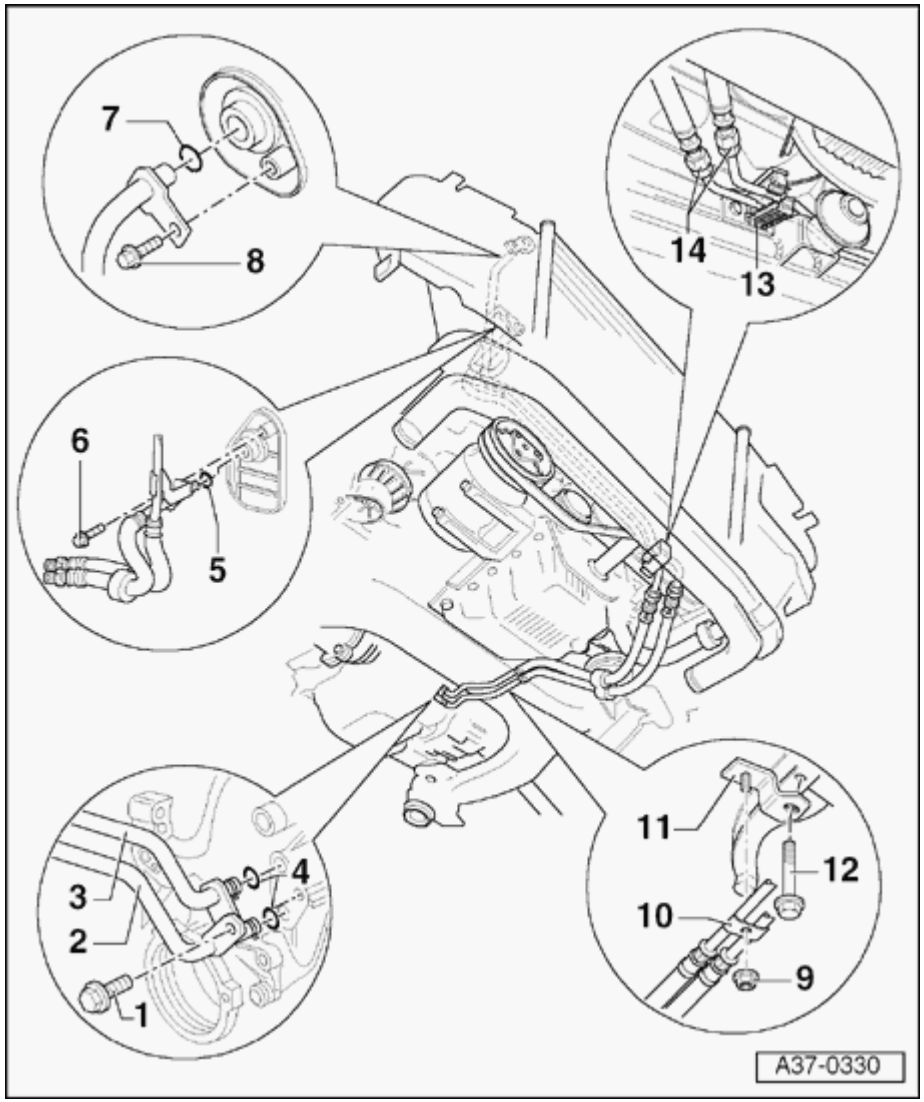


- Unclip vent hose for alternator -1-.
- Unbolt bracket for ATF line -2- at oil pan.



- Separate ATF lines -1- to ATF cooler.
- Plug ATF lines with clean plug.
- Unbolt bracket for ATF line -3-.
- Remove transmission side starter bolt -2-.

37-80



Vehicles with 4 cylinder engine

- Remove bolt -12- to separate bracket for ATF line -11- from engine.
- Remove bolt -1-.
- Pull off lines -2- and -3- from transmission.
- Plug lines and openings at transmission with clean plugs.
- Lay lines aside so they are not damaged.

37-81

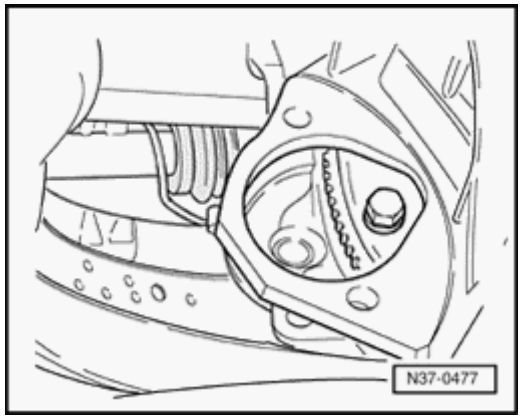
All except 2.7 Liter 5V turbo engine:

- Remove starter.

⇒ *Repair Manual, Electrical Equipment, Repair Group 27; Starter, removing and installing*

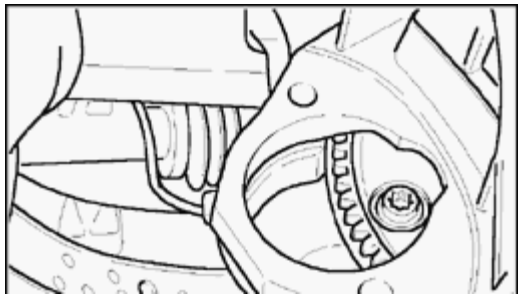
Disconnect torque converter from drive plate

For vehicles with hex bolts:



- Remove torque converter from drive plate by removing 3 bolts using special tool V175 (turn crank shaft an additional 1/3 turn every time).

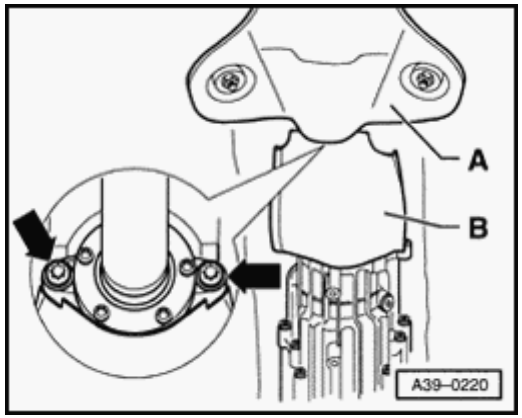
For vehicles with Torx bolts:



- Unbolt 3 torque converter bolts from drive plate using respective Torx insert (turn crank shaft an additional 1/3 turn every time).

37-82

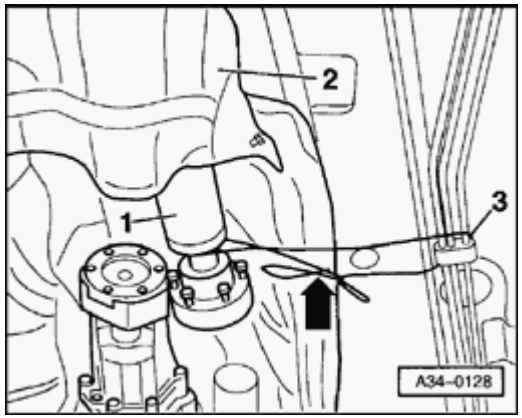
All-wheel-drive vehicles



- Remove heat shield -A- above driveshaft.
- Remove rear part of exhaust system if necessary:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

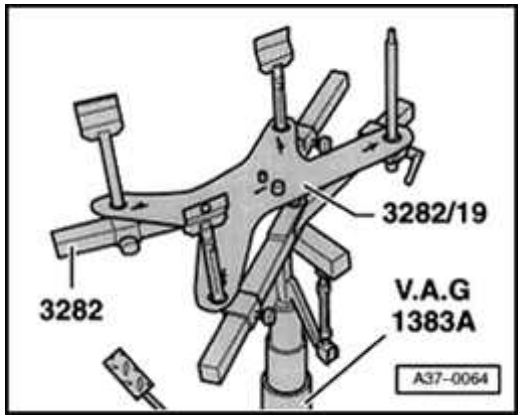
- Remove heat shield -2- for driveshaft from cover for Torsen differential (arrows).



- Unbolt driveshaft from transmission and hang or support.

37-83

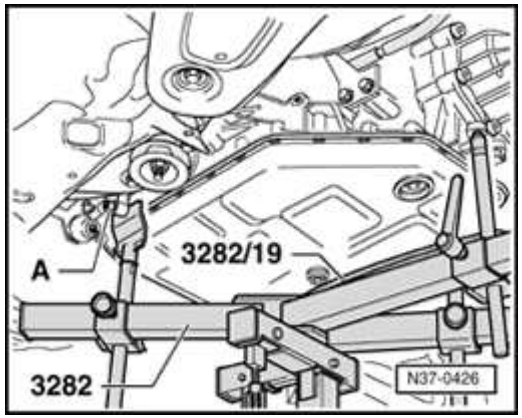
Continuation for all vehicles



- Position 3282 transmission support.

Use 3282/19 adjustment plate to position the 3282 transmission support for Automatic Transmission 01V.

The symbols on the adjustment plate indicate the necessary mounts and the arrow points toward front of vehicle.

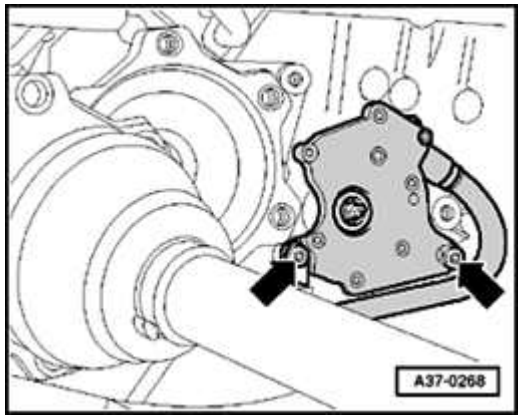


- Roll VAG1383A engine/transmission hoist with 3282 transmission support under transmission and support transmission.
- Align adjustment plate parallel to transmission.
- Secure transmission on 3282 transmission support using bolt -A-.

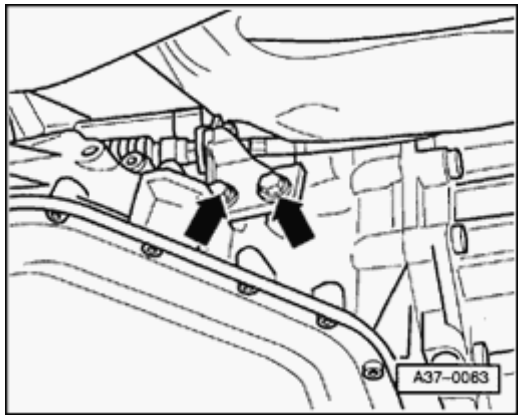
Automatic Transmission 01V with All Wheel Drive is supported at the same positions as the Front Wheel Drive version.

- Remove left and right transmission support with transmission mount ⇒ page 37-125

37-84

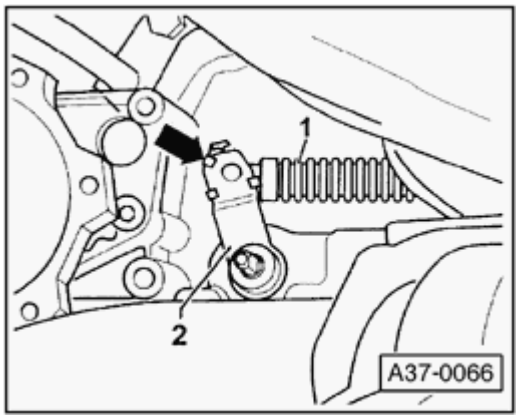


- Unbolt multi-function Transmission Range (TR) switch -F125- for protection against damage (arrows) and expose wiring harness.

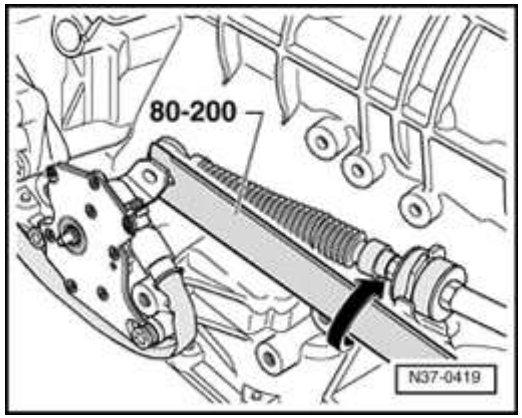


- Mark position of mounting bracket for selector lever cable to transmission housing for re-installation, unbolt mounting bracket (arrows).

37-85

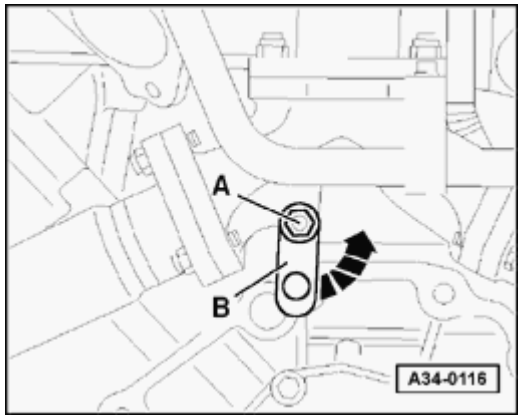


- If installed, press off securing brace (arrow) at end of selector lever cable.



- Pry off selector lever cable from lever/shift rod (arrow).
- Remove upper connecting bolts for engine/transmission.

For 6 cylinder TDI engines

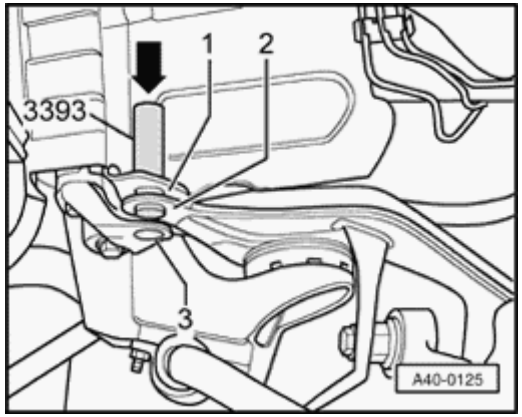


- Loosen bolt -A- (at rear of turbocharger) several turns and rotate brace -B- to side in arrow direction. Then re-tighten bolt -A- lightly.

Note:

Illustration depicts engine from rear with the transmission removed.

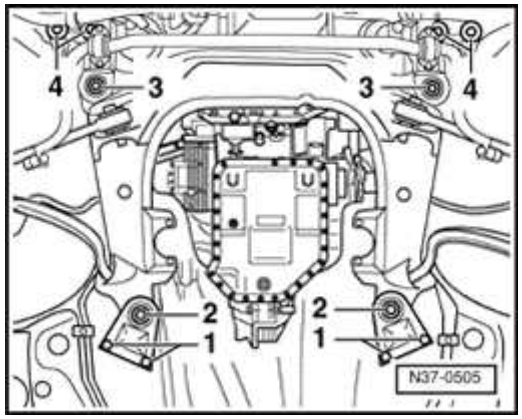
Continuation for all vehicles



- Before loosening subframe, it must be checked whether holes -1- and -2- (at least) line up using 3393 testing mandrel.

If this is not the case, an axle alignment must be performed after the carrier is installed.

37-87



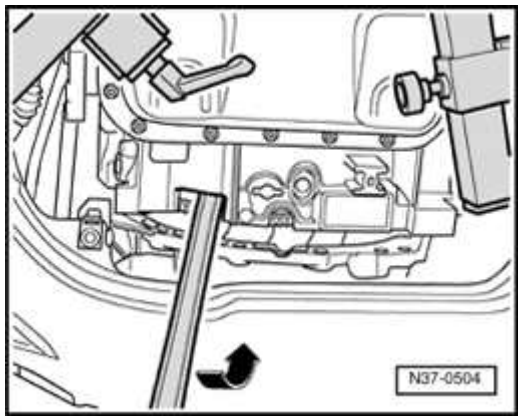
- Remove bolts -1- and -2- at rear of subframe on both sides of vehicle.
- Completely remove bolts -3- at front of subframe on both sides of vehicle.

By removing the bolts, the subframe lowers itself approx. 150 mm at rear edge ⇒ page 37-88 , illustration A37-0067.

- Slightly lower engine/transmission subframe at rear above VAG1383A hoist.
- Remove front exhaust pipes:

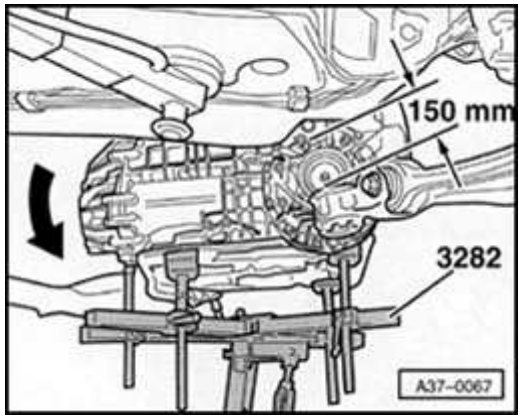
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

- Remove remaining connection bolts for engine/transmission.
- Press transmission off engine, while pressing torque converter out of drive plate.



- Press torque converter against the ATF pump (arrow).

37-88



- Rotate transmission (arrow) and carefully move into position between subframe and vehicle floor.
- Lower transmission.
- Secure converter so it does not fall out.

37-89

Installing

Installation is reverse of removal, noting the following:

Before installing:

All-wheel-drive vehicles

- Clean threads in driveshaft flange!

Continuation for all vehicles

- Clean ATF lines ⇒ page 37-158 .

- Insert torque converter into transmission ⇒ page 32-8 .

WARNING!

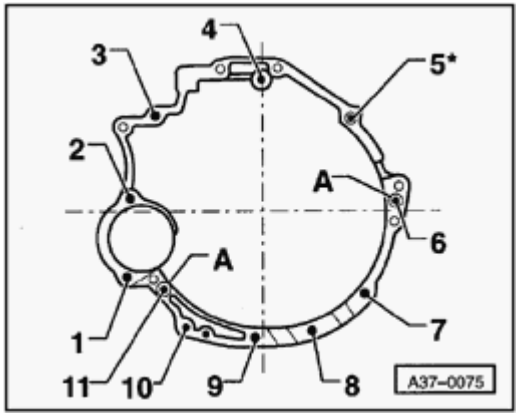
Check installation dimension of torque converter before installing transmission ⇒ page 32-8

- Make sure bushings are correctly seated.

Note:

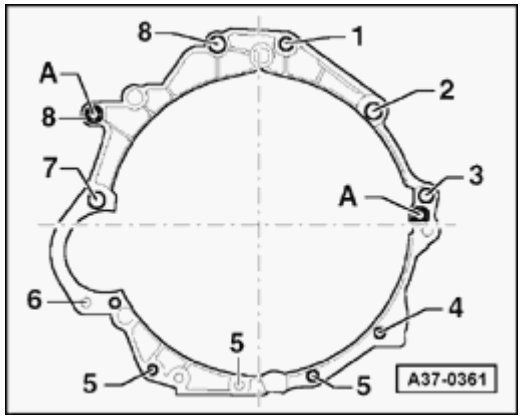
If the bushings get stuck in the transmission housing, they must be removed and new bushings must be installed on the engine.

37-90



➢ **For 4 cylinder engines (5 valve, turbo)**

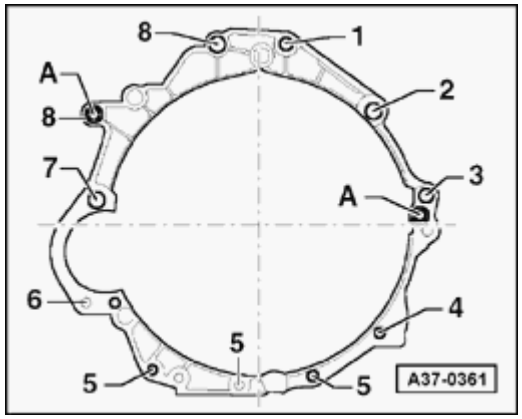
Item A = bushings



➢ **For 6 cylinder gasoline engines:**

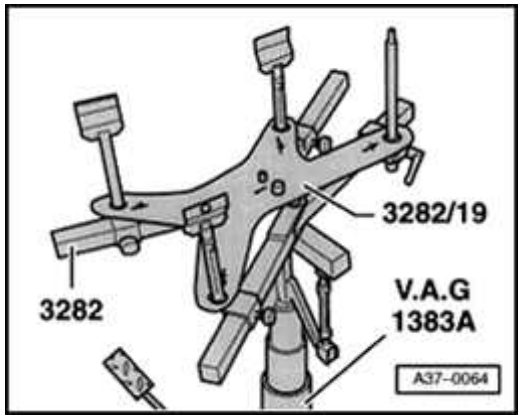
Item A = bushings

37-91



For 6 cylinder TDI engines

Item A = bushings



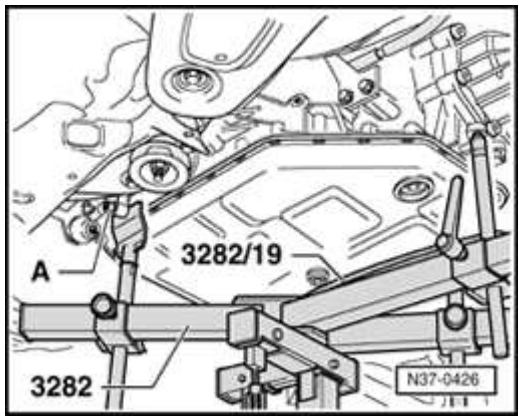
- Position 3282 transmission support.

Use 3282/19 adjustment plate to position the 3282 transmission support for Automatic Transmission 01V.

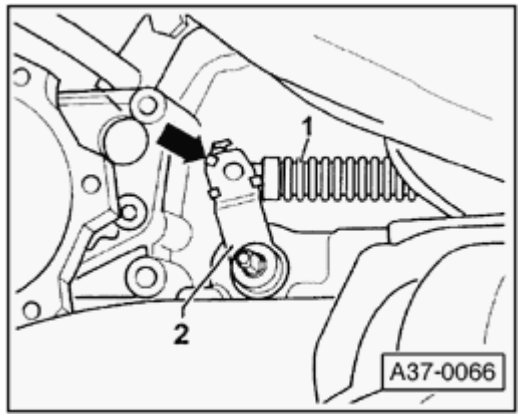
The symbols on the adjustment plate indicate the necessary mounts and the arrow points toward front of vehicle.

37-92

- Place transmission onto transmission support.



- Secure transmission on 3282 transmission support using bolt -A-.
- Move transmission into position between the lowered subframe and vehicle floor.



- Press the lever/shift rod -2- at transmission completely toward rear (toward right in illustration) until park lock is engaged.
- Shift selector lever into "P" and carefully press up ball head of selector lever cable on lever/shift rod -2- using a pair of pliers.
- If installed, press securing brace (arrow) open at end of selector lever cable.

Note:

Do not deform lever/shift rod when pressing up or else shifting cannot be precisely adjusted any more.

- Align transmission properly to engine.

37-93

Note:

- *If installed, place intermediate plate onto bushings.*
- *Make sure that wires do not get pinched as transmission is docked at engine.*

Check whether the torque converter is still properly installed and has not slid out of the converter housing toward the font:

- It must be possible to easily turn torque converter by hand without much force.

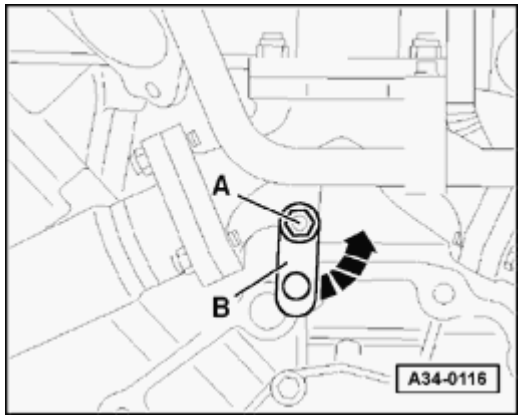
WARNING!

In case of an incorrectly inserted torque converter, the coupling plate of the torque converter or the ATF-pump will be destroyed, if the transmission is flanged to the engine.

- If the torque converter is difficult to move, check installation dimension once again ⇒ page 32-8 .

37-94

For 6 cylinder TDI engines



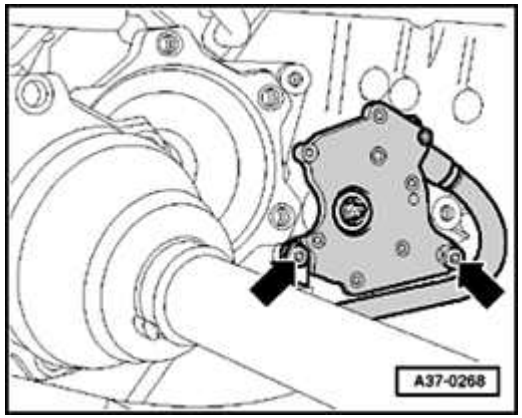
- Check whether brace -B- is still swung to side (arrow direction) before installing the transmission.

Continuation for all vehicles

- Install connecting bolts for engine/transmission.

Note:

Some bolts also have a bracket or a Ground (GND) connection attached ⇒ refer to tightening torque tables starting ⇒ page 37-119 onward.



- Install multi-function Transmission Range (TR) switch -F125-.
- Slightly raise engine/transmission subframe at rear via VAG1383A hoist.
- Install remaining connecting bolts for engine/transmission.
- Install front exhaust pipes:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

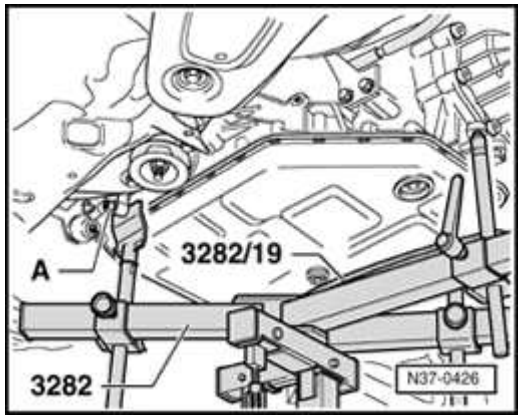
- Install subframe, observe tightening sequence and alignment with master hole.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Subframe, removing and installing*

- Only perform vehicle alignment if necessary.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 44; Vehicle alignment*

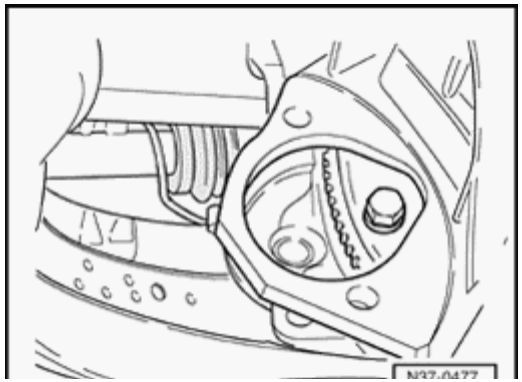
- Install transmission supports at left and right with transmission mount ⇒ page 37-125



- Remove bolt -A- after transmission is bolted to engine.
- Apply corrosion protection to contact surface between bolt -A- and oil pan.

Bolt torque converter to drive plate

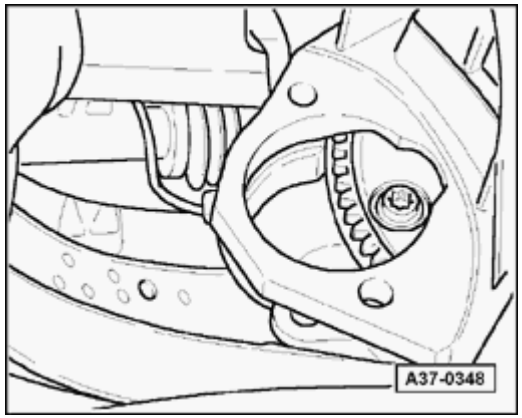
For vehicles with hex bolts:



- Bolt torque converter to drive plate via 3 bolts using special tool V175 (turn crank shaft an additional 1/3 turn every time).

37-96

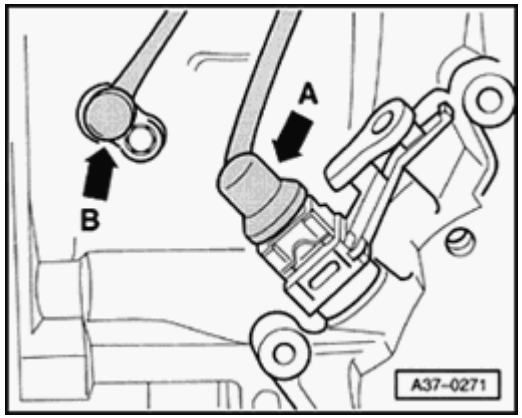
For vehicles with Torx bolts:



- Bolt 3 torque converter bolts to drive plate using respective Torx insert (turn crank shaft an additional 1/3 turn every time).
- Install starter.

⇒ *Repair Manual, Electrical Equipment, Repair Group 27; Starter, removing and installing*

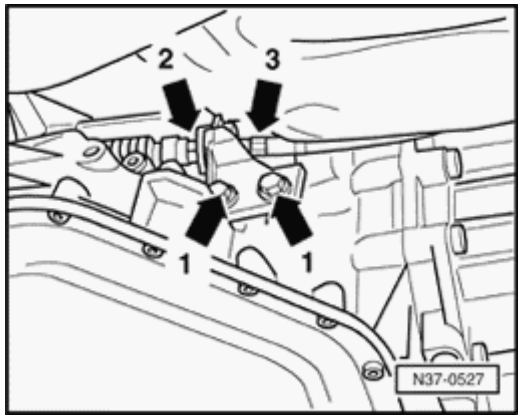
- Install ATF lines to engine/transmission subframe.
- Install bracket for ATF- line.
- Slightly raise engine/transmission subframe at rear via VAG1383A hoist.



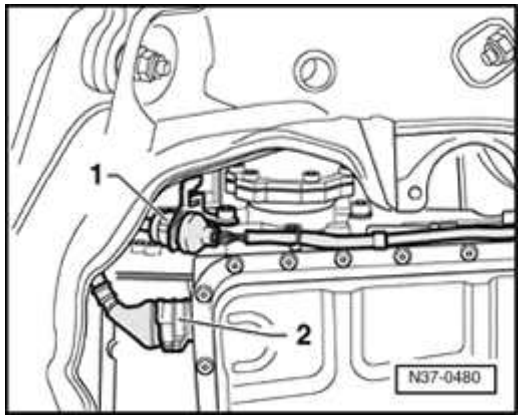
- Bolt in engine speed (RPM) sensor -G28- (arrow -B-) at front left of transmission (if installed).
- Connect connector for speedometer Vehicle Speed Sensor (VSS).
- Bolt drive axles to transmission flanges.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

37-97



- Bolt in bolts at mounting bracket of selector lever cable, install selector lever cable and if necessary, adjust.

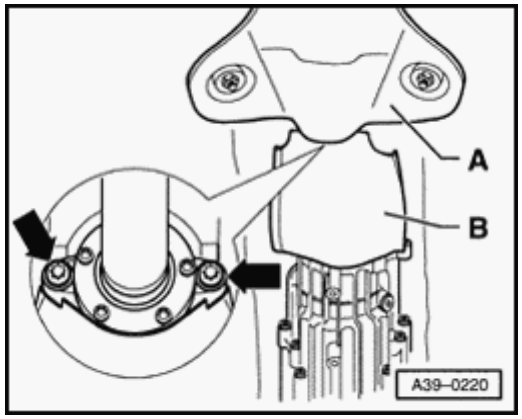


- Connect connector of multi-function Transmission Range (TR) switch -1-.
- Connect connector for transmission wiring harness and secure using securing lever -2-.
- Install shielding plate/selector lever cable

All-wheel-drive vehicles

- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.

37-98



- Bolt heat shield -B- for driveshaft to Torsen differential cover (arrows) if installed.
- Install heat shield -A- above driveshaft.

Continuation for all vehicles

- Install bracket for noise insulation panel.
- Install noise insulation panel.
- Install front wheels.
- Connect battery Ground (GND) strap.
- Check adjustment of selector lever cable ⇒ page 37-45 .
- Check gear oil in final drive with transmission installed ⇒ page 39-1 .
- Then check ATF level and top off ⇒ Page 37-133 onward.
- After connecting battery, enter anti-theft code for radio.

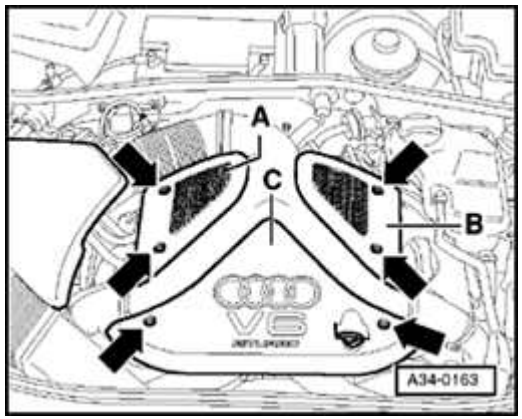
⇒ *Radio operating manual*

- Fully close power windows to stop.
- Then activate all power window switches ("up") for at least one second to activate automatic window raising/lowering.
- Set clock to correct time.

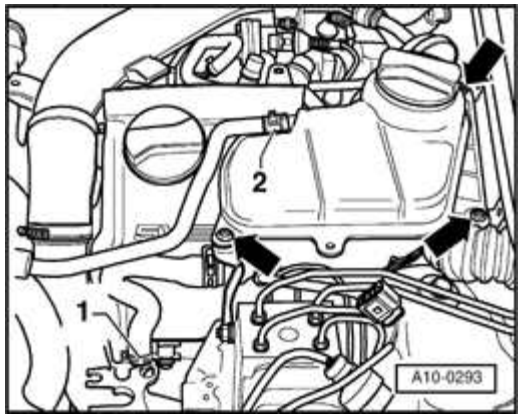
Tightening torque table ⇒ Page 37-119 onward.

37-99

Removing and installing for 2.7 Liter 5V turbo engine:

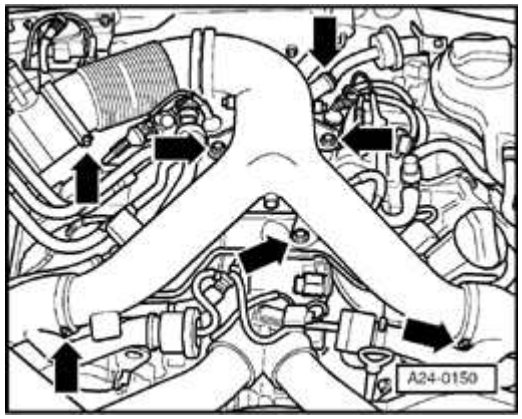


- Remove bolts (arrows) and remove engine covers -A- and -B-.
- Remove cover above air filter.

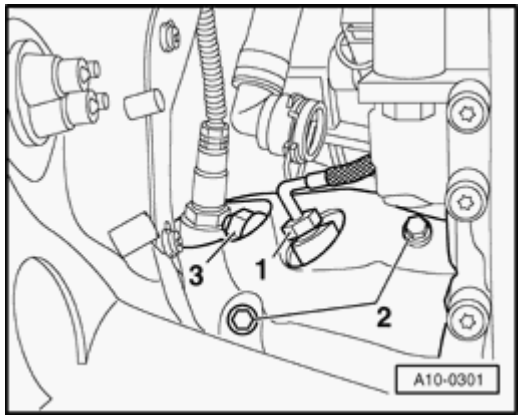


- Remove coolant expansion tank (arrows) and lay to side.
- Disconnect connector for coolant level display.
- Remove cover from valve cover (cylinder bank 4-6).

37-100

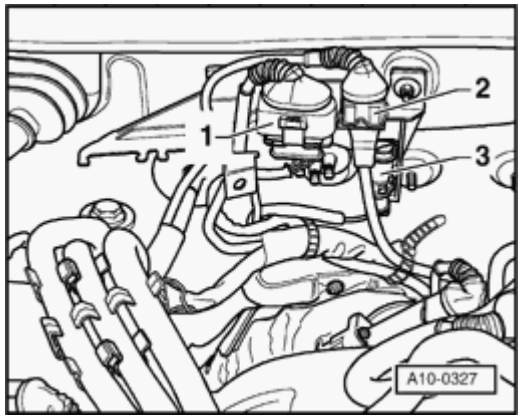


- Remove air distributor (arrows).

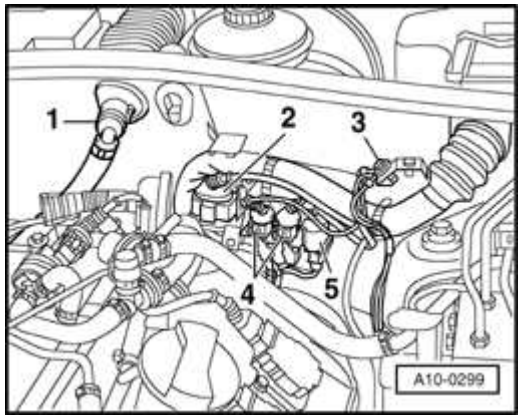


- Remove heat sensor -1- from right turbocharger using 3035.
- Remove heat shields -2- from left and right turbochargers.
- Remove upper bolts -3- to front line to left and right turbochargers.

37-101



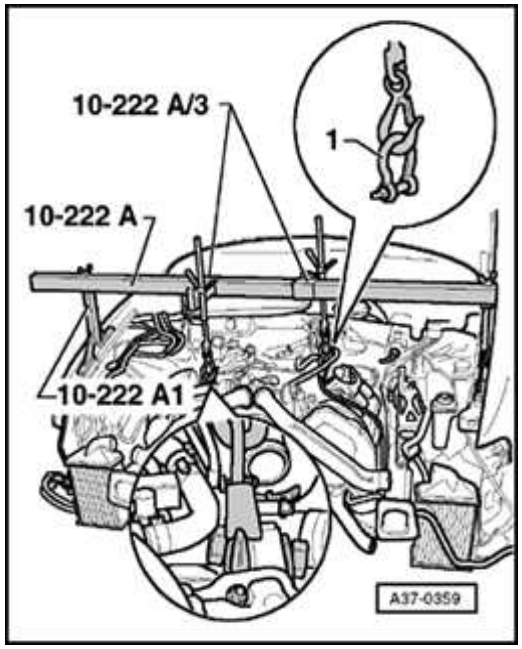
- Disconnect connector -1- for oxygen sensor (right side) at bulkhead.
- Expose wire with connector to oxygen sensor.



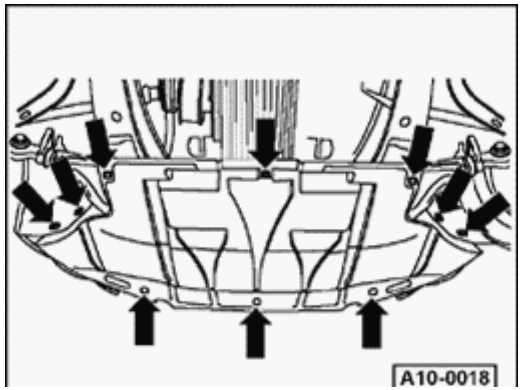
- Disconnect connectors -2- of left oxygen sensor at bulkhead and remove lower part of connectors from bracket.
- Expose wire with connector to oxygen sensor.
- Remove all connecting bolts for engine/transmission which can be reached from the top.

37-102

- Assemble both 10-222A/3 engine support adapters for front and rear spindles on support bar.

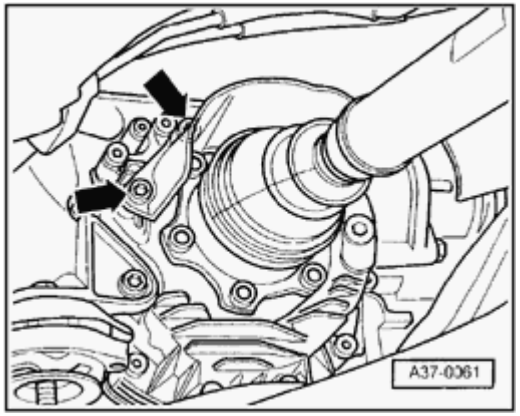


- Set 10-222A engine support bridge onto the fender mounting flanges using 10-222A/1 brackets.
- Hang both spindles on the adapters.
- Secure engine to spindles. To do so, additionally use a shackle -1- at the rear side of the engine to avoid damage.
- Take up weight of engine/transmission assembly on spindles.
- Tighten the rear spindle less, to enable later lowering at rear.
- Raise vehicle.
- Remove front wheels.



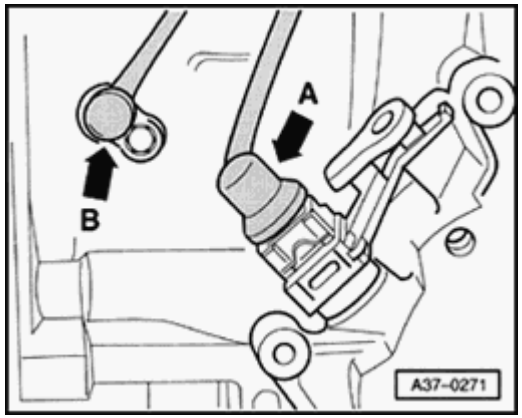
- Remove sound-deadening pan.
- Remove bracket for noise insulation panel.

37-103



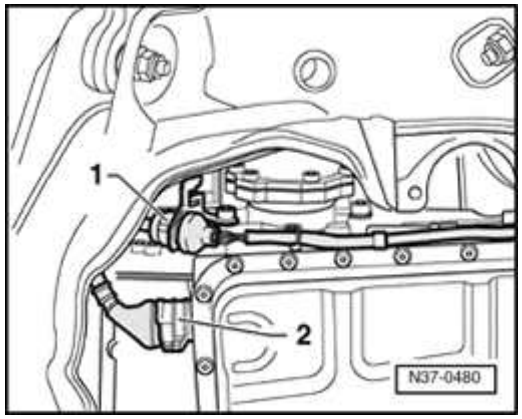
- Remove left and right heat shields for drive axles (arrows).
- Disconnect drive axles from transmission drive flanges.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

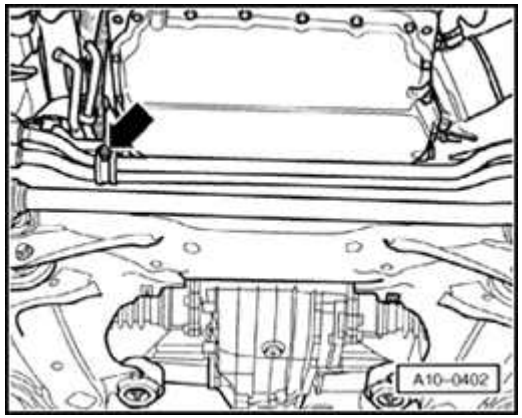


- Unbolt engine speed (RPM) sensor -G28- (arrow B) from transmission at front left.
- Remove connector for speedometer (arrow -A-) from transmission.

37-104



- Disconnect connector -1- from wire for multi-function switch.
- Swing securing lever -2-, disconnect connector for transmission wiring harness.

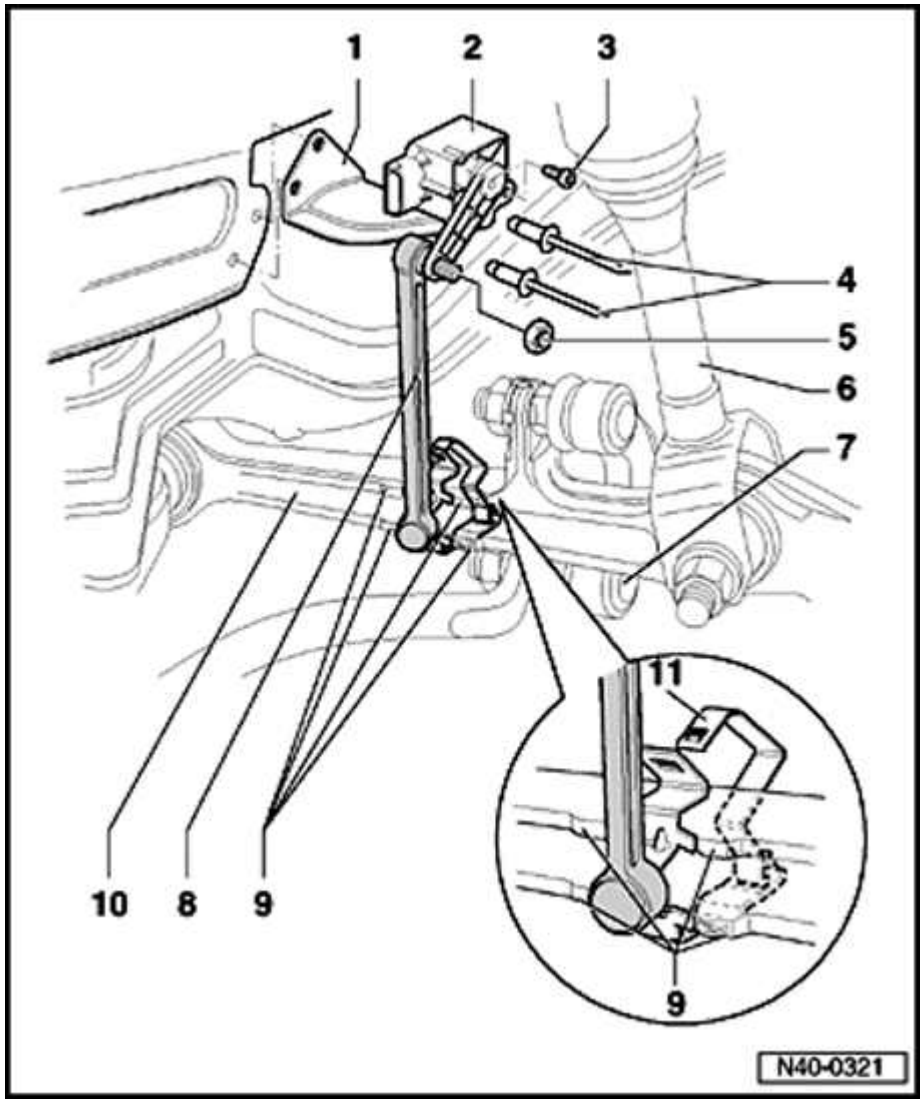


- If necessary, remove A/C line from oil pan (arrow) for better access to the starter.

WARNING!

Do not open refrigerant circuit for A/C system.

37-105



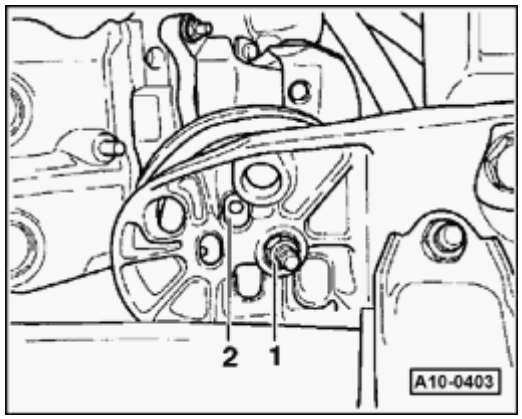
For vehicles with the illustrated vertical headlight aim control system, notes in the following repair manuals must be observed before lowing subframe;

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; control arm removing and installing; sensor for vehicle leveling in vehicles with automatic vertical headlight aim control regulation.*

Otherwise the sensor may be destroyed.

37-106

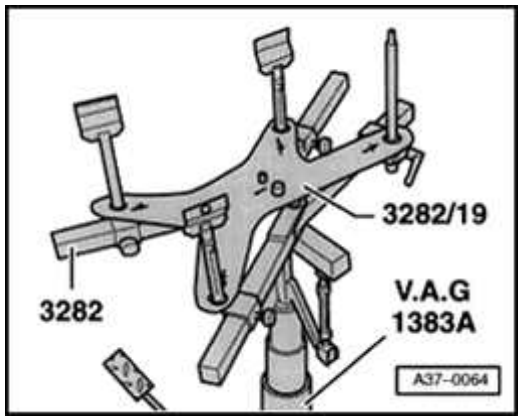
- Loosen left and right transmission mounts from subframe ⇒ page 37-125



- Mark installation positions for threaded assemblies -1- and positioning sleeves -2-.
- Remove nuts -1- on left and right engine mounts.

Note:

When installing, make sure that locating sleeves -2- engage again.

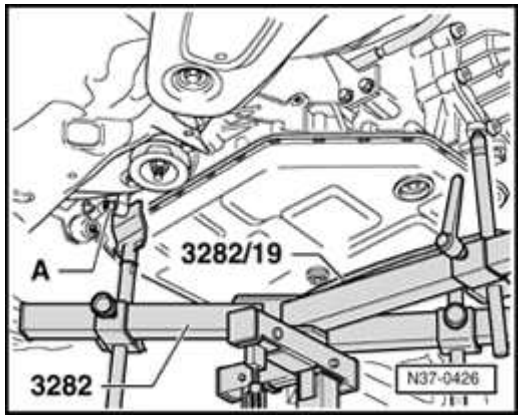


- Position 3282 transmission support.

Use 3282/19 adjustment plate to position the 3282 transmission support for Automatic Transmission 01V.

The symbols on the adjustment plate indicate the necessary mounts and the arrow points toward front of vehicle.

37-107

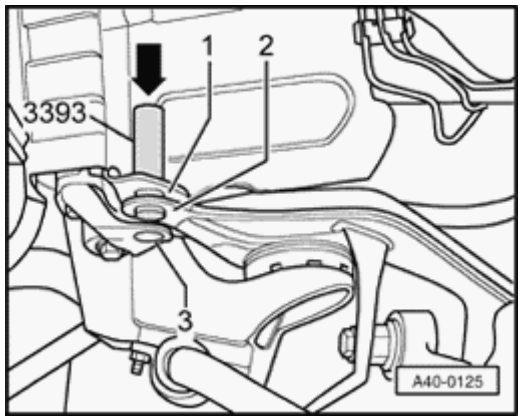


- Roll VAG1383A engine/transmission hoist with 3282 transmission support under transmission and support transmission.
- Align adjustment plate parallel to transmission.
- Secure transmission on 3282 transmission support using bolt -A-.

Automatic Transmission 01V with All Wheel Drive is supported at the same positions as the Front Wheel Drive version.

WARNING!

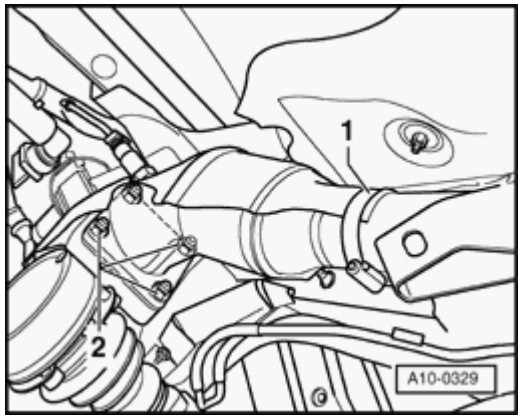
When working on the subframe, all precautions and notes which are listed in ⇒ Repair Manual, Suspension, Wheels, Steering must be must be observed.



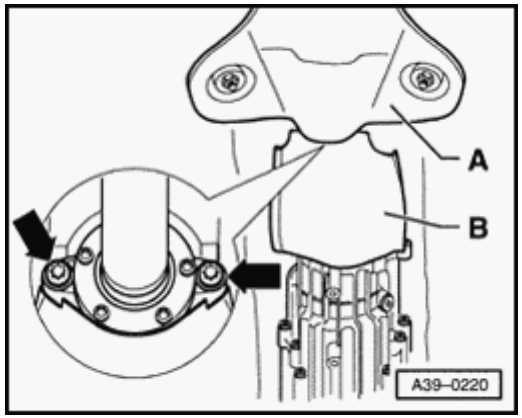
- Before loosening carrier, special tool 3393 must be used to check whether holes -1- and -2- line up.
- Completely lower subframe at rear and front.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Subframe, removing and installing*

37-108



- Mark installation position of protector shield and hose clamp -1- at left and right exhaust pipe using a waterproof marker, to quickly find the correct installation position when re-installing.
- Remove hose clamp -1- from left and right protector shield for turbocharger.
- Unbolt left and right exhaust pipes -2- from turbocharger.

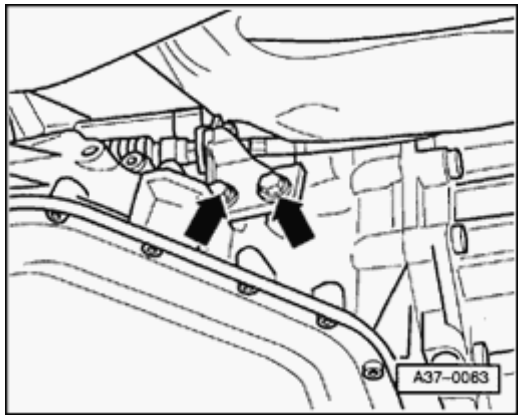


- Remove heat shield -A- above driveshaft.
- Remove rear part of exhaust system if necessary:

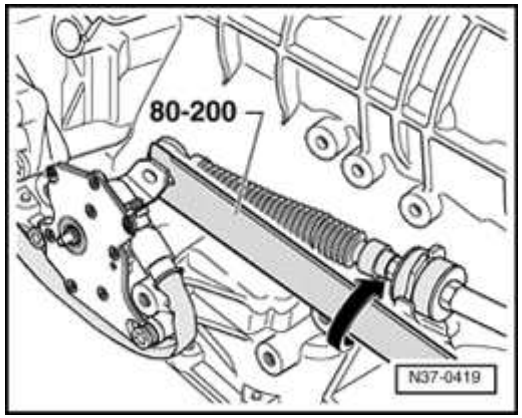
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

- Remove heat shield -2- for driveshaft from cover for Torsen differential (arrows).
- Unbolt driveshaft from transmission and hang or support.

37-109



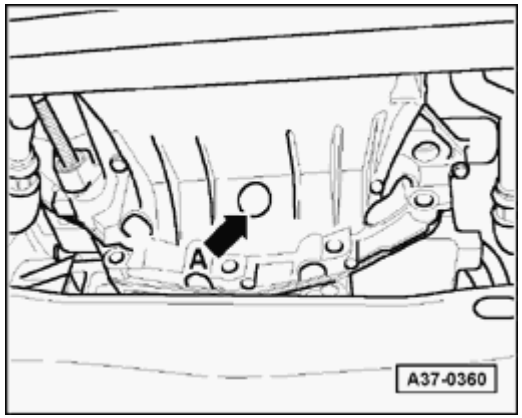
- Mark position of mounting bracket for selector lever cable to transmission housing for re-installation, unbolt mounting bracket (arrows).



- Pry off selector lever cable from lever/shift rod using 80-200 (arrows).

37-110

Removing 3 torque converter bolts

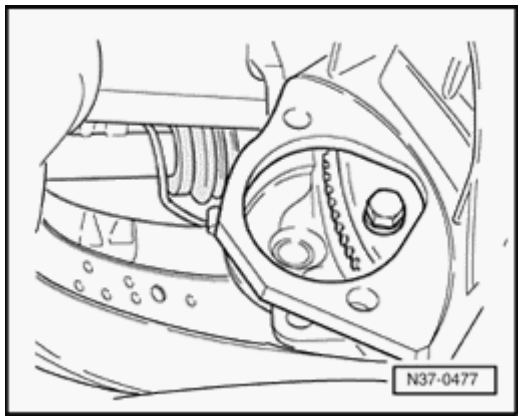


- Remove plug above opening -A- in engine flange.
- Remove torque converter bolts from drive plate via opening -A- in engine flange (turn crankshaft 1/3 rotation each time).

If opening -A- is not present, perform the following two work steps to be able to remove the 3 bolts of the torque converter.

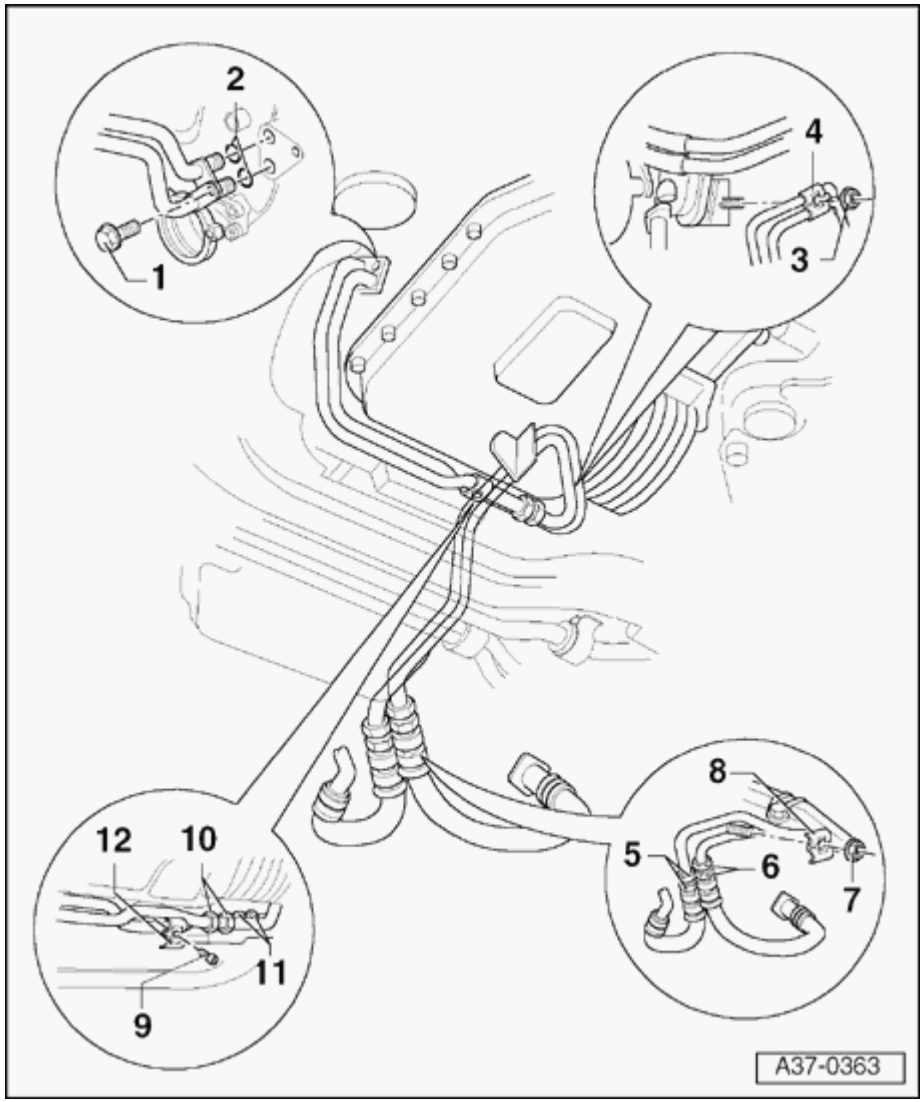
- Remove starter.

⇒ *Repair Manual, Electrical Equipment, Repair Group 27; Starter, removing and installing*



- Remove torque converter from drive plate by removing 3 bolts using special tool V175 (turn crank shaft an additional 1/3 turn every time).

37-111

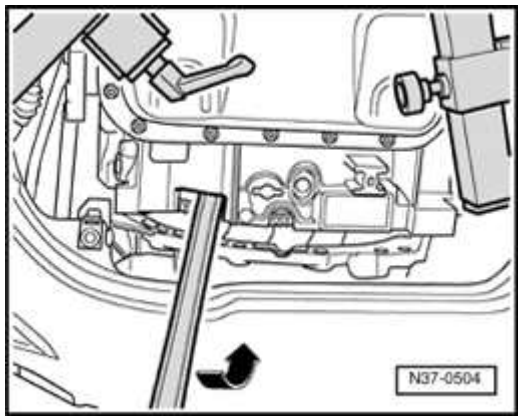


- Remove bolt -9- with bracket -12-.
- Disconnect ATF lines at bolts -10- and -11- and plug the lines with clean plugs.
- Loosen nut -3- with bracket -4- in order to prevent tension when removing and installing.

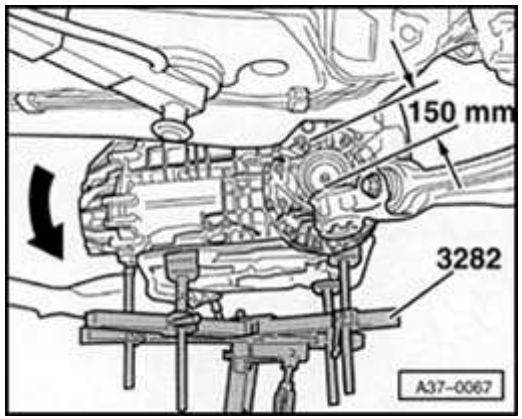
37-112

- Remove remaining connection bolts for engine/transmission.

- Press transmission off engine, while pressing torque converter out of drive plate.



- Press torque converter against the ATF pump (arrow).



- Rotate transmission (arrow) and carefully move into position between subframe and vehicle floor.
- Lower transmission.
- Secure converter so it does not fall out.

37-113

Installing

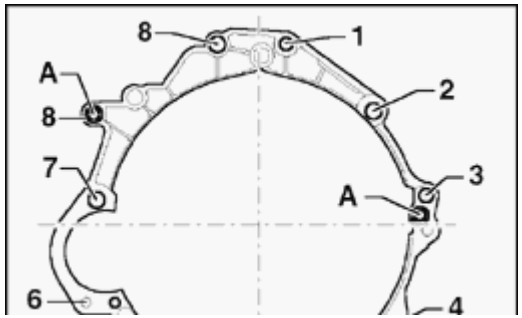
Installation of transmission is the reverse of removal. The following points must also be observed:

Before installing:

- Clean threads in driveshaft flange using a tap.
- Clean ATF lines ⇒ page 37-158 .
- Insert torque converter into transmission ⇒ page 32-8 .
- Make sure bushings are correctly seated.

Note:

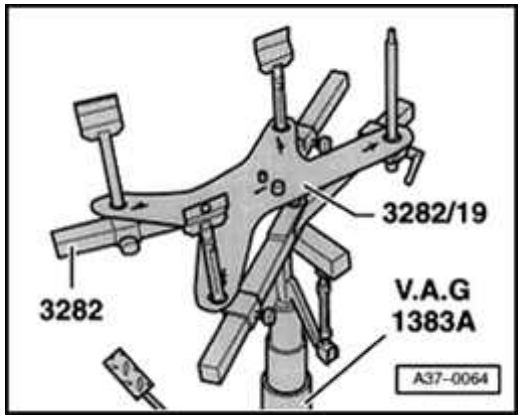
If the bushings get stuck in the transmission housing, they must be removed and new bushings must be installed on the engine.



For 2.7l 5V turbo engines

Item A = bushings

37-114

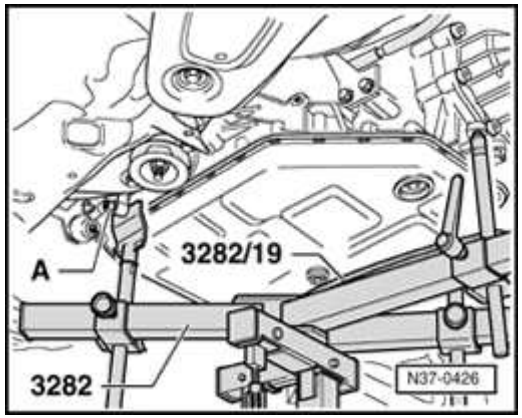


- Position 3282 transmission support.

Use 3282/19 adjustment plate to position the 3282 transmission support for Automatic Transmission 01V.

The symbols on the adjustment plate indicate the necessary mounts and the arrow points toward front of vehicle.

- Place transmission onto transmission support.

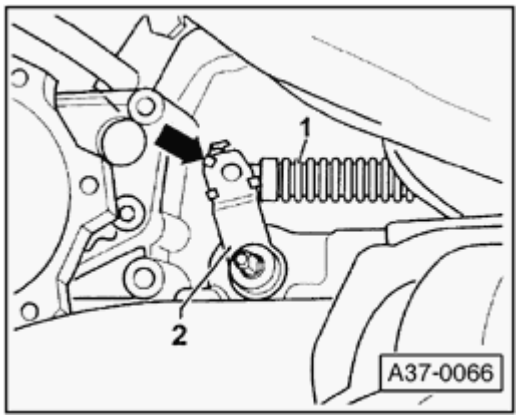


- Secure transmission on 3282 transmission support using bolt -A-.
- Move transmission into position between the lowered subframe and vehicle floor.

During this, the subframe is lowered approx. 150 mm at rear ⇒ page 37-88 , illustration A37-0067.

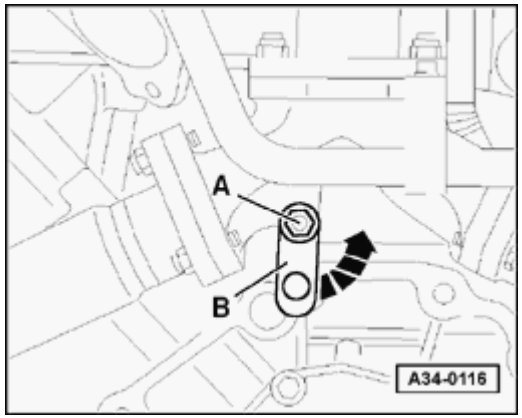
- Align transmission properly to engine.

37-115



- Press the lever/shift rod -2- at transmission completely toward rear (toward right in illustration) until park lock is engaged.
- Shift selector lever into "P" and carefully press up ball head of selector lever cable on lever/shift rod -2- using a pair of pliers.

Note:



Do not deform lever/shift rod when pressing up or else shifting cannot be precisely adjusted any more.

Note:

- *Place intermediate plate onto bushings.*
- *Make sure that wires do not get pinched as transmission is docked at engine.*

Check whether the torque converter is still properly installed and has not slid out of the converter housing toward the font:

- It must be possible to easily turn torque converter by hand without much force.

37-116

WARNING!

In case of an incorrectly inserted torque converter, the coupling plate of the torque converter or the ATF-pump will be destroyed, if the transmission is flanged to the engine.

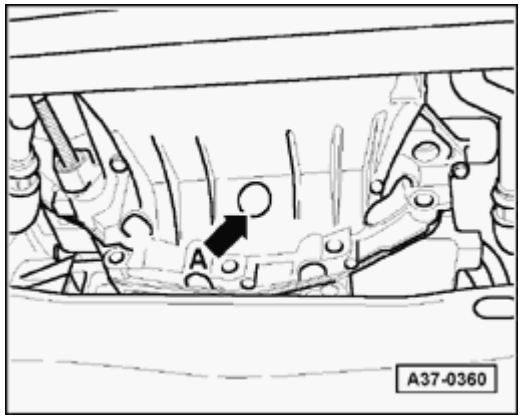
- If the torque converter is difficult to move, check installation dimension once again ⇒ page 32-8 .

- Install connecting bolts for engine/transmission.

Note:

Some bolts also have a bracket or a Ground (GND) connection attached ⇒ refer to tightening torque tables starting ⇒ page 37-119 onward.

37-117



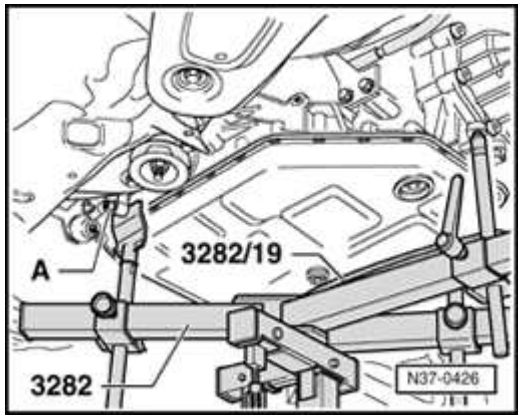
- Install bolts of torque converter through opening -A- in engine flange to the drive plate (turn crankshaft 1/3 rotation each time).
- Insert plug into opening -A- in engine flange.
- Install subframe, observe tightening sequence and alignment with master hole.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Subframe, removing and installing*

- Only perform vehicle alignment if necessary.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 44, Vehicle alignment*

- Install transmission supports at left and right with transmission mount ⇒ page 37-125



- Remove bolt -A- after transmission is bolted to engine.
- Apply corrosion protection to contact surface between bolt -A- and oil pan.
- Bolt on ATF lines ⇒ page 37-149

- Bolt drive axles to transmission flanges.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.

- After connecting battery, enter anti-theft code for radio.

⇒ *Radio operating manual*

- Check adjustment of selector lever cable ⇒ page 37-45 .

- Check gear oil in final drive with transmission installed ⇒ page 39-1 .

- Then check ATF level and top off ⇒ Page 37-133 onward.

- Fully close power windows to stop.

- Then activate all power window switches ("up") for at least one second to activate automatic window raising/lowering.

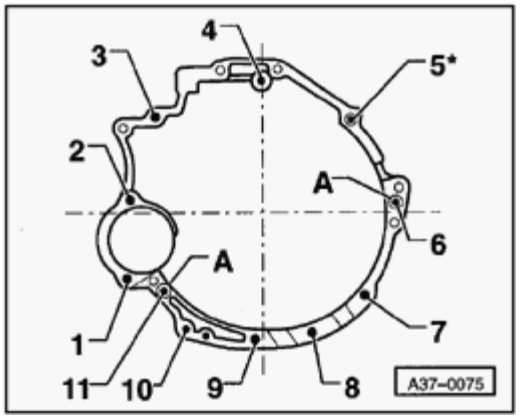
- Set clock to correct time.

37-119

Tightening torques

Notes:

- *Tightening torques are valid only for nuts and bolts that are lightly greased, oiled, covered with a thin coat of phosphate or blackened.*
- *Other lubricants are permitted, e.g. engine oil or transmission fluid, however they may not contain graphite.*
- *Do not use any degreased parts.*



Engine/transmission mount for 4 cylinder engines (5 valve, turbo)

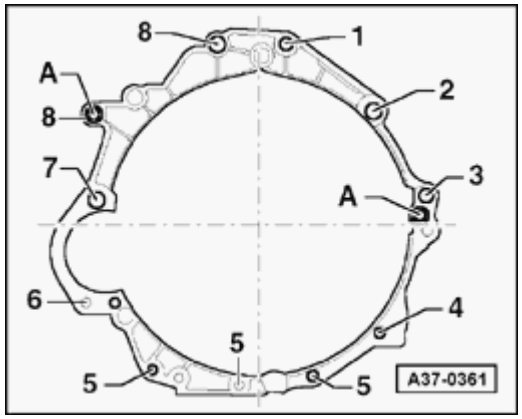
Item no.	Bolt	Nm
1, 8, 9, 10	M10 X 45	45
2, 3, 4, 11	M12 X 67	65
5	M12 x 110	65
6	M12 x 90	65
7 [1)]	M10 x 60	45

[1)] With nut

Item A = bushings

Bolts -3- and -5- also secure a bracket for cables.

37-120



Engine/transmission mount for 6 cylinder gasoline engines except for 2.7 Liter 5V turbo engine

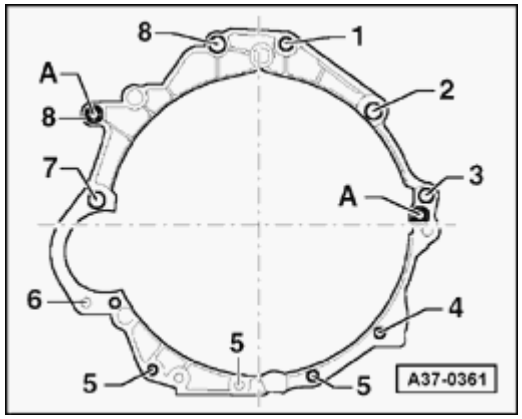
Item no.	Bolt	Nm
1	M12 X 67	65
2	M12 x 90	65
3	M12 x 75	65
4 [1)]	M10 x 60	45
5	M10 X 45	45
6	M10 x 80	65
7 [2)]	M12 x 110	65
8	M12 X 67	65

[1)] With nut

[2)] With bracket for ATF- lines

Item A = bushings

37-121



Engine/transmission mount for 6 cylinder TDI engines

Item no.	Bolt	Nm
1 3)	M12 x 80	65
2 4)	M12 x 90	65
3	M12 x 75	65
4 1)	M10 x 60	45
5	M10 X 45	45
6	M10 x 80	65
7 2)	M12 x 110	65
8 2)	M12 X 67	65

1) With nut

2) With bracket for ATF- lines

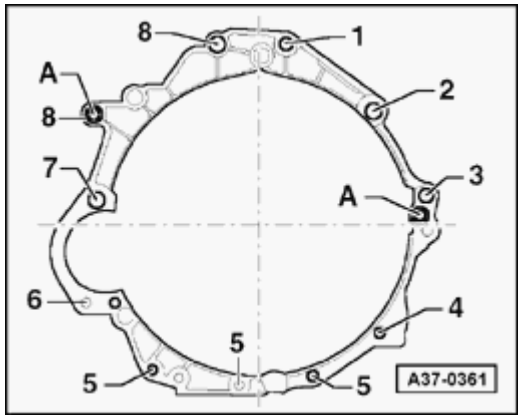
3) With bracket for turbocharger

4) With bracket for cables

5) With additional Ground (GND) connection

Item A = bushings

37-122



Engine/transmission mount for 2.7l 5V turbo engines

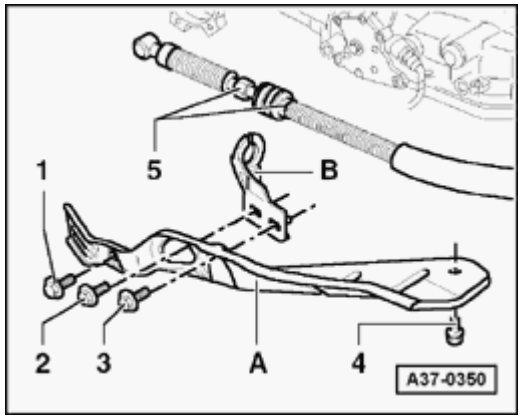
With 11 mm intermediate plate

Item no.	Bolt	Nm
1	M12 x 90	65
2	M12 x 100	65
3	M12 x 90	65
4 [1)]	M10 x 70	45
5	M10 x 60	45
6	M10 x 100	65
7	M12 x 110	65
8	M12 x 80	65

[1)] With nut

Item A = bushings

37-123

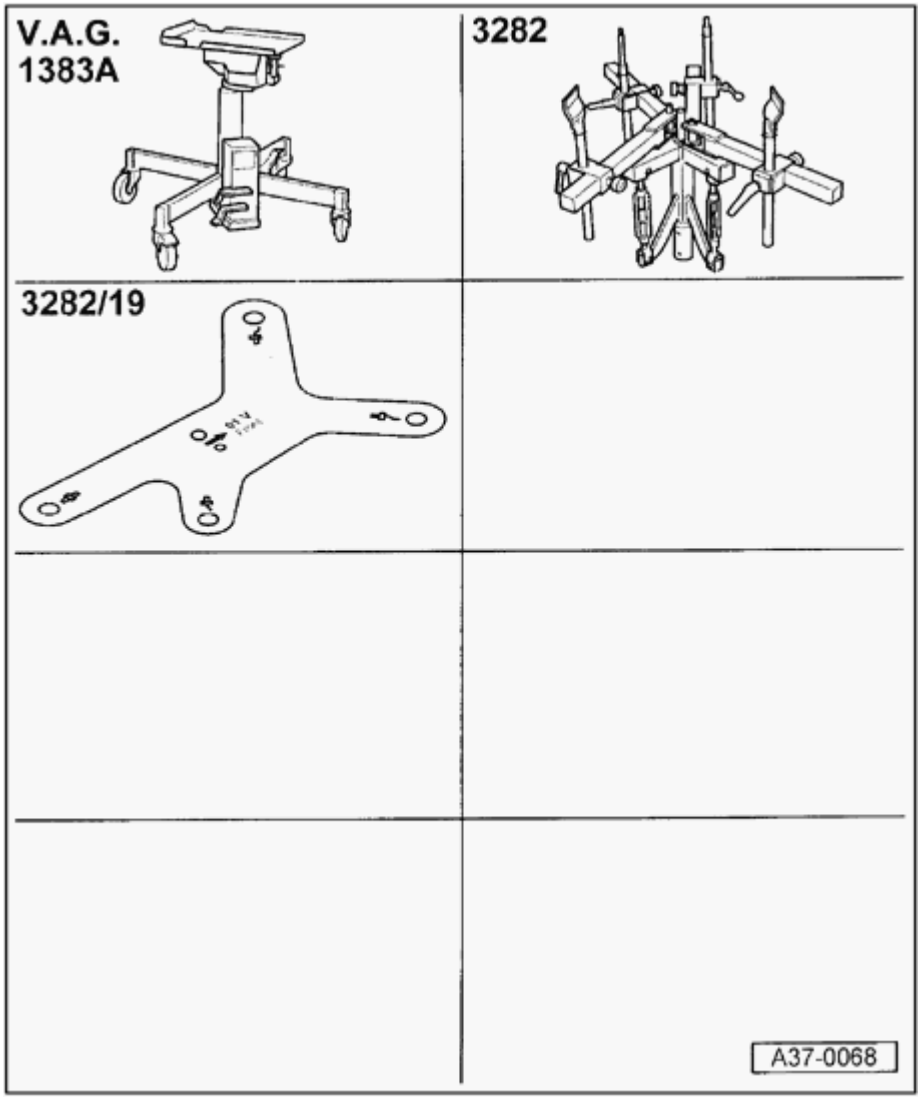


Valid for all engine/transmission types:

Components		Tightening torques
Mounting bracket to transmission (2x M8), item no. 2 and 3		23 Nm
Heat shield/selector lever cable to transmission, item no. 1		
	M6	9 Nm
	M8	23 Nm
Heat shield/selector lever cable to transmission, M8, item no. 4		23 Nm
Selector lever cable to mounting bracket -B-, item no. 5		12 Nm

Component		Nm
Nuts/Bolts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Drive plate to Torque converter	M10 x1	85
Installing ATF lines		Page ⇒ Page 37-149 onward
multi-function Transmission Range (TR) switch -F125- to transmission		8
Three Way Catalytic Converter (TWC) to mounts		25
Bracket for noise insulation to subframe		10
Heat shield for drive axle		25
Heat shield to turbocharger		10

37-125



Right and left transmission mounts, removing and installing

Special Tools and equipment

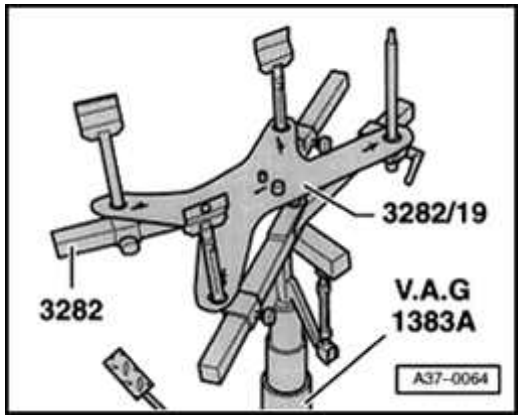
- Engine/transmission support VAG1383A engine/gearbox jack
- 3282 transmission support
- 3282/19 adjustment plate

37-126

Removing

Note:

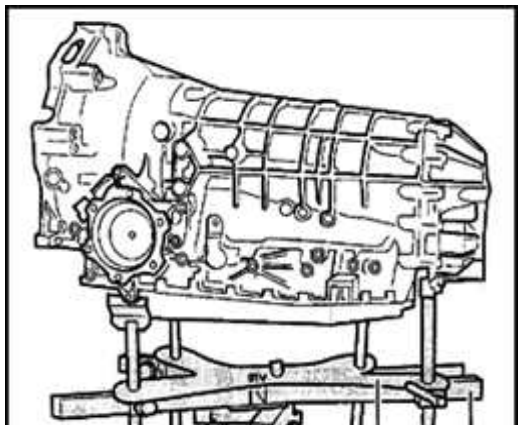
Transmission must be supported as indicated when both transmission supports are removed. Transmission does not need to be supported this way when only one of the transmission supports is being removed.



- Prepare 3282 transmission support for Automatic Transmission 01V with3282/10 adjustment plate and place it on the VAG1383A engine/transmission hoist.

Note:

The symbols on the adjustment plate indicate the necessary mounts for Automatic Transmission 01V and the arrow points toward front of vehicle.



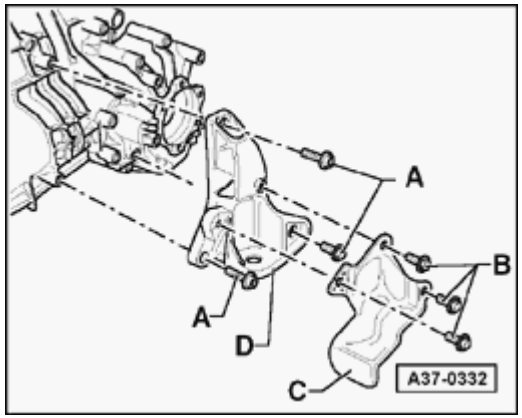
- Roll VAG1383A engine/transmission hoist with 3282 transmission support under transmission and support transmission.

Note:

If 3282 transmission support is not available, transmission can be supported using the VAG1383A transmission lift and the 1359/2 universal mount.

37-127

Right transmission support



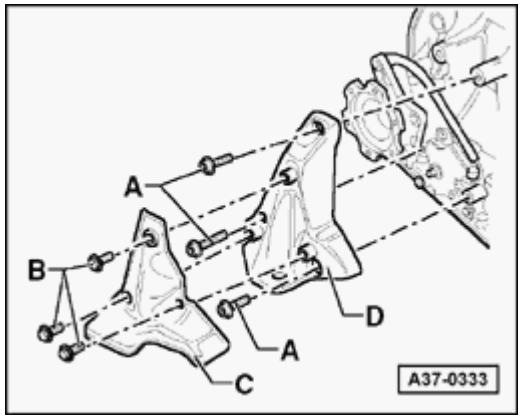
- Remove heat shield -C-.

Note:

The right heat shield is not installed on 6 cylinder TDI engines.

- Remove right heat shield -D- by removing bolts -A- from transmission.

Left transmission support



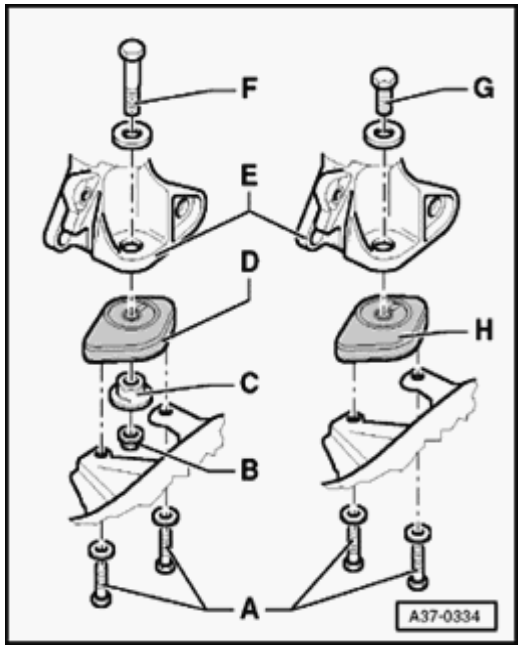
- Remove heat shield -C-.

Note:

The left heat shield is not installed on 4 cylinder gasoline engines.

- Remove left heat shield -D- by removing bolts -A- from transmission.

37-128



Left and right transmission supports

- Remove transmission supports -E-.

D - transmission mount (traditional)

H- hydraulic transmission mount

Note:

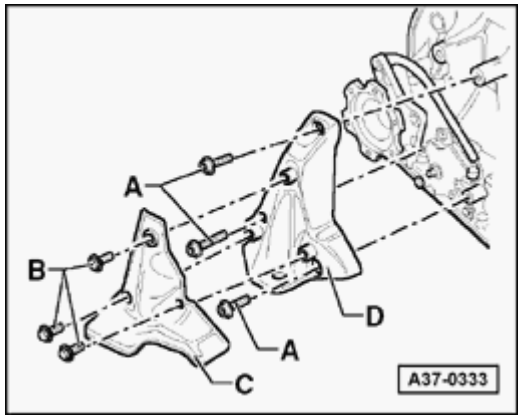
Items -C- and -B- are not installed on vehicles with hydraulic transmission bearing -H-, because bolt -G- is threaded directly into the transmission bearing.

Installing

Installation is the reverse of removal.

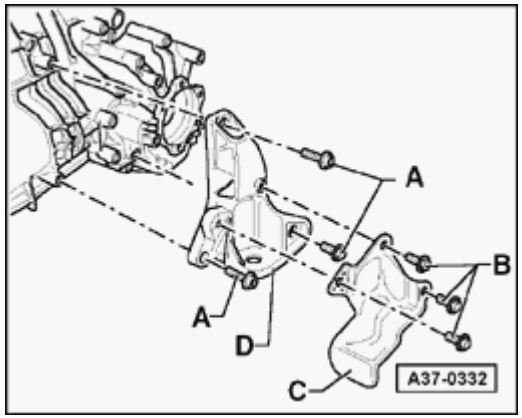
Tightening torques for left and right transmission supports

Item no.	Bolt	Number	Nm
A	M 8 x 22	2 each	27
B to F	M 10 x 70	1	50
G	M 10 x 35	1	50



Tightening torques for left transmission support

Item no.	Bolt	Number	Nm
A	M 10 x 30	2	40
	M 10 x 50	1	
B	M 6 x 22	3	10



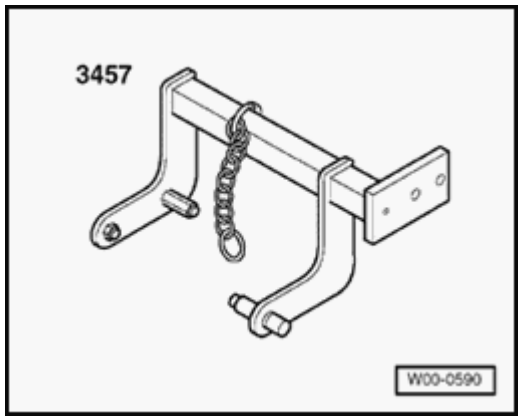
Tightening torques for right transmission support

Item no.	Bolt	Number	Nm
A	M 10 x 30	3	40
B	M 6 x 22	3	10

37-130

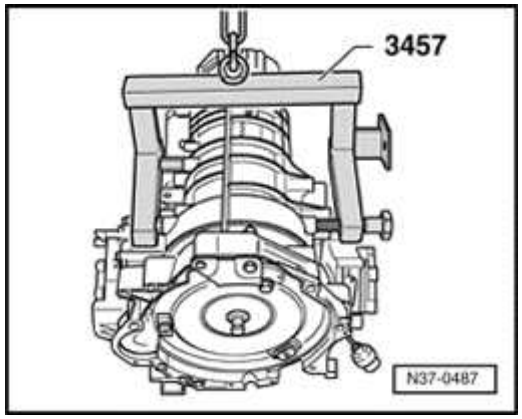
Automatic transmission, transporting

Special tools and equipment



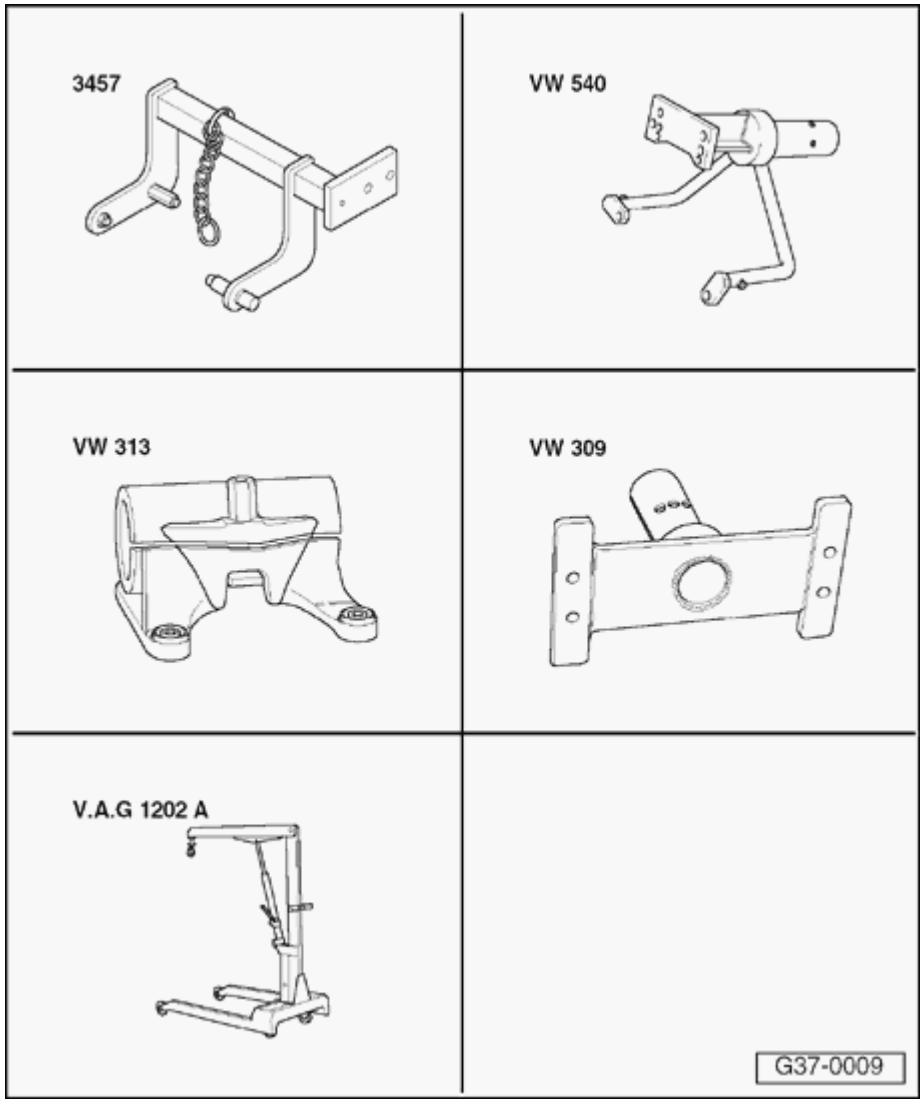
- 3457 attachment and holding rig

The 3457 attachment and holding rig can be used when transporting the transmission and for setting up the 3282 transmission support.



- Attach the 3457 attachment and holding rig at the transmission housing mounts and secure.

37-131

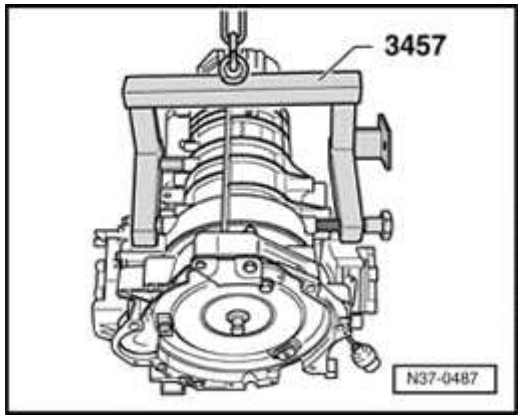


Transmission, attaching to assembly stand

Special Tools and equipment

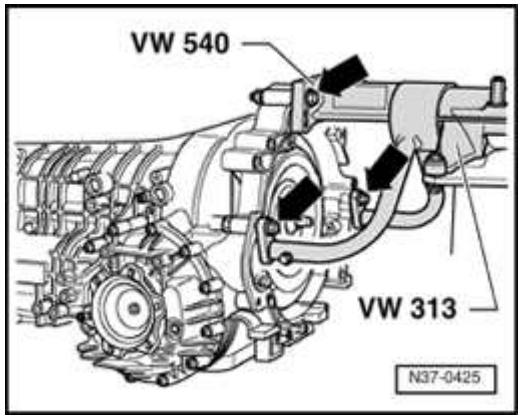
- 3457 attachment and holding rig
- VW540 holding fixture (only for transmission with FWD)
- VW313 holding fixture
- VW309 holding plate
- VAG1202A engine hoist

37-132



- Attach the 3457 attachment and holding rig at the transmission housing mounts and secure.
- Bolt the attachment and holding rig to the VW 309 holding plate and place this into the VW313 holding fixture using a workshop crane.

For transmissions with Front Wheel Drive (FWD), the VW540 holding fixture can also be used to secure the transmission to the VW313 holding fixture.



- Secure transmission to VW540 holding fixture (arrows) and insert in VW313 holding fixture.

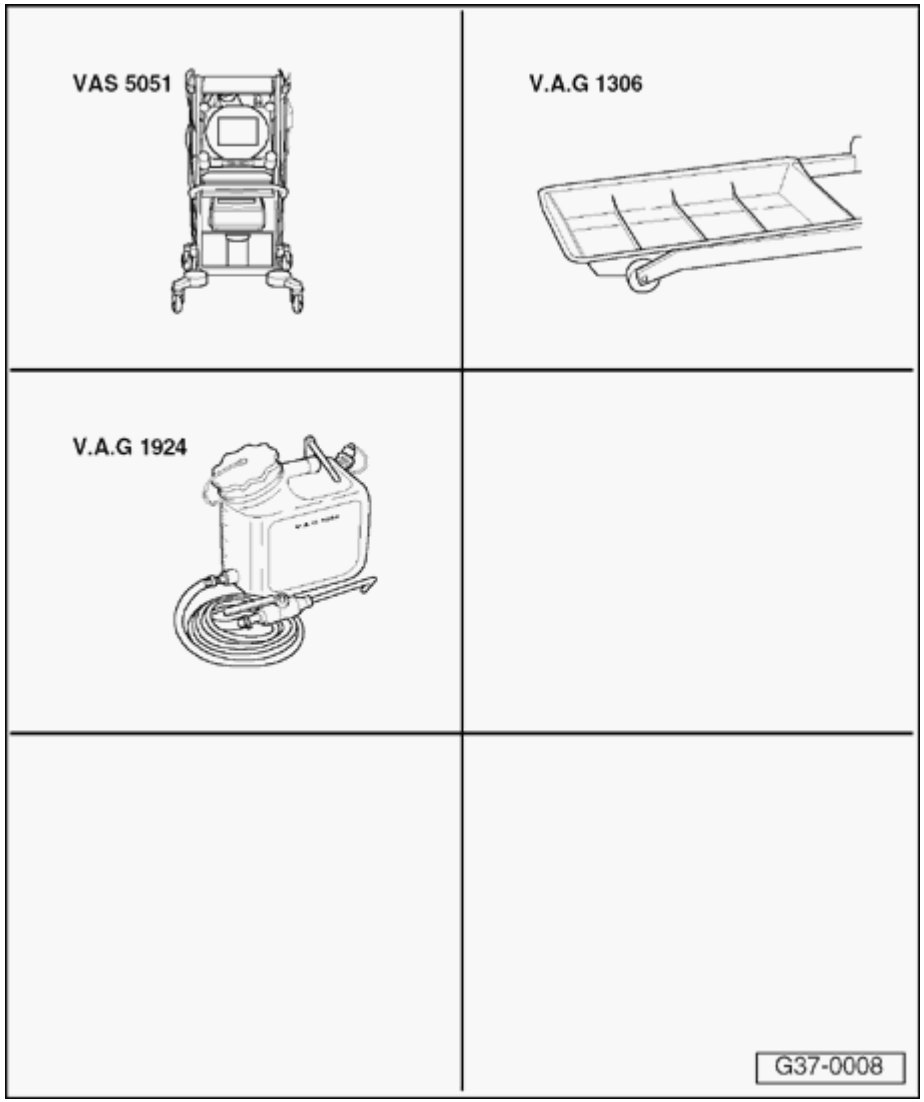
WARNING!

The center of gravity of the transmission is located outside the turning center at holding fixture. To turn the transmission, a second technician must hold the transmission housing to prevent back-swing.

Note:

Vents for the transmission housing and final drive must be closed before turning a filled transmission on the assembly stand so that the oil pan faces upward .

37-133



Automatic Transmission Fluid (ATF), checking and changing

ATF level, checking

Special Tools and Equipment

- VAS5051 tester with VAS5051/1 diagnostic cable (or VAG1551 scan tool with VAG1551/3 cable)
- VAG1306 drip tray
- VAG1924 ATF filler tool
- Protective glasses

37-134

Test requirements:

- Transmission must not be in emergency running mode.
- Vehicle on level ground.
- Selector lever in "P", let engine run at idle.
- A/C system and heating switched off.
- ATF temperature must not be higher than 30° C at start of test, allow transmission to cool down if necessary.

Notes:

- *ATF level changes with ATF temperature.*
- *Performing ATF level check when ATF temperature is too low causes overfilling.*
- *Performing ATF level check when ATF temperature is too high causes insufficient filling.*
- *Excess filling and insufficient filling both affect*

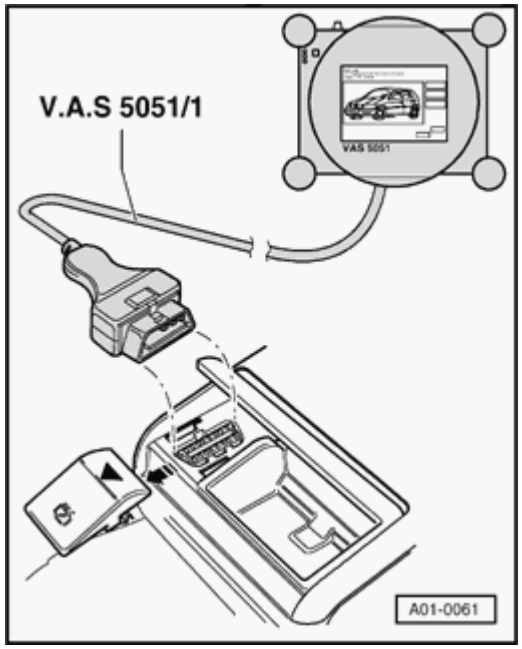
the function of the transmission.

- *An extra ATF check must be performed for vehicles with auxiliary ATF cooler ⇒ page 37-138*

- *The ATF temperature is read out by the VAS5051 tester or VAG1551 Scan Tool (ST).*

37-135

Checking ATF temperature



- Connect VAS5051 tester to vehicle with VAS5051/1 diagnostic wire. Alternately, VAG1551 Scan Tool (ST) can also be attached using VAG1551/3 adapter.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board Diagnostic (OBD), Repair Group 01, Performing On Board Diagnostic (OBD)*

- Start engine.

Rapid data transfer	**HELP**
Select function XX	

When indicated on display:

- Press buttons -0- and -8- to select "Read measuring value block" and press -Q- button to confirm input.

Read measuring value block	**Q**
Enter display group number XXX	

When indicated on display:

- Press buttons -0-, -0- and -4- to select display group "004" and press -Q- button to confirm input.

Read measuring value block	**4** →

When indicated on display:

- Read ATF temperature in display field 1.

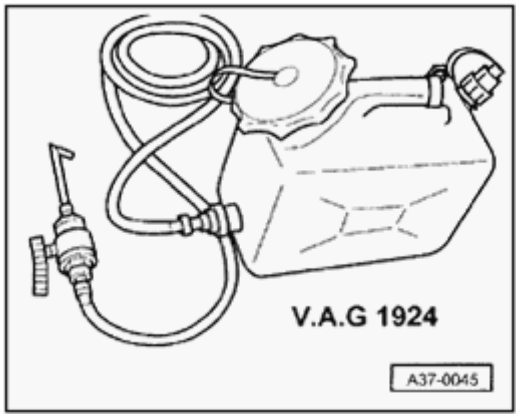
37-136

Checking and correcting ATF level

Notes:

- *ATF level is checked at the ATF check plug.*
- *ATF level is correct if a little bit of fluid still escapes at the ATF check plug between 35 °C and 45 °C [1] (dependant on the fluid level when warming up).*

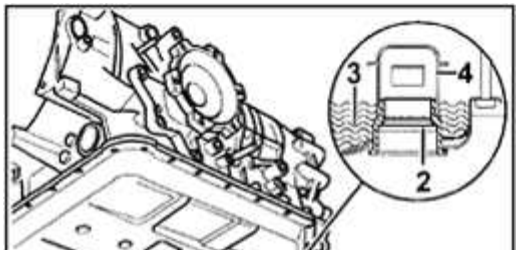
[1] For warm countries 50 °C



- Secure container of VAG1924 ATF filler tool as high up on vehicle as possible.
- Raise vehicle.
- Place VAG1306 drip tray under transmission.

WARNING!

Wear protective glasses.



- Once an ATF temperature of 35 °C is reached, remove ATF check plug -2- and drain excess ATF if necessary.

- If ATF exits from the ATF filler plug hole before the ATF reaches 40 °C, the ATF level is OK.

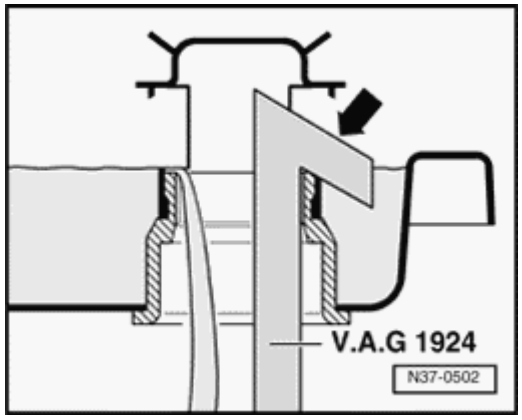
Note:

ATF check plug must be closed again by 45 °C [1] at the latest ⇒ page 37-137 .

[1] For warm countries 50 °C

- Add ATF if no ATF has escaped from the ATF check plug hole by 40 °C.

- Insert VAG1924 ATF filler tool into an opening -4- in the protective cap, but do not knock cap upward.



- Fill with ATF using VAG1924 ATF filler tool until ATF exits from the check hole.

- Always replace seal (arrow) for ATF check plug.
- Tighten ATF check plug to 80 Nm.
- → Press button on VAG1551.
- Press buttons -0- and -6- to select "End output" and press -Q- button to confirm input.

37-138

ATF level, checking (vehicles with auxiliary ATF cooler)

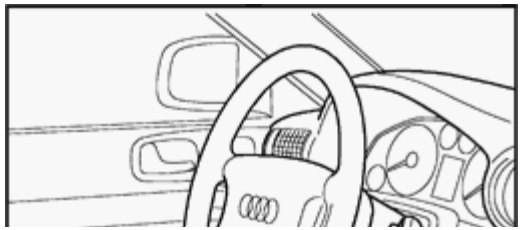
This test must be performed after auxiliary ATF cooler has been emptied or when it has been replaced. Installation position of the auxiliary ATF cooler ⇒ page 37-157 , item A.

Test requirements:

- Transmission must not be in emergency running mode.
- ATF is filled up ⇒ 37-140
- Selector lever in "P", let engine run at idle.
- A/C system and heating switched off.

♦ *The ATF temperature is read out by the VAS5051 tester or VAG1551 Scan Tool (ST).*

Checking ATF temperature

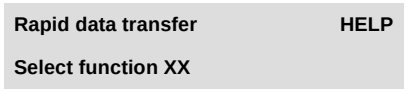


- Connect VAS5051 tester to vehicle with VAS5051/1 diagnostic wire. Alternately, VAG1551 Scan Tool (ST) can also be attached using VAG1551/3 adapter.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V On Board*

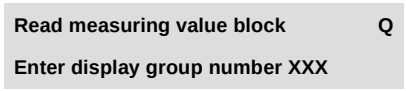
Diagnostic (OBD), Repair Group 01, Performing On Board Diagnostic (OBD)

- Start engine.



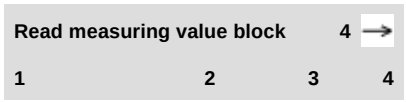
When indicated on display:

- Press buttons -0- and -8- to select "Read measuring value block" and press -Q- button to confirm input.



When indicated on display:

- Press buttons -0-, -0- and -4- to select display group "004" and press -Q- button to confirm input.



When indicated on display:

- Read ATF temperature in display field 1.
- Let engine run until ATF temperature has reached at least 85 ° C, a road test may be necessary to reach this temperature.

Note:

The thermostat at the opening for the auxiliary ATF cooler does not open until 80 ° C so that the cooler can fill up with ATF.

The content of the auxiliary ATF cooler is 140 ml. of ATF.

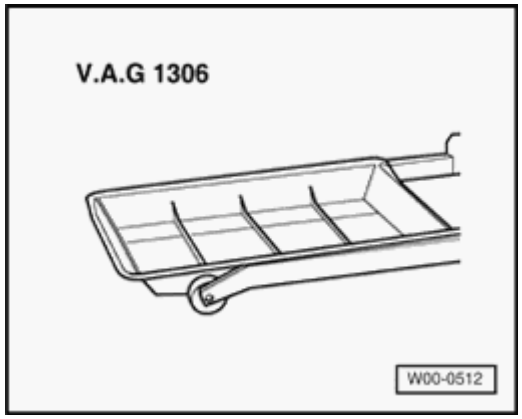
- Switch off engine and let ATF cool down again until temperature has fallen below 35 ° C.
- Check ATF level ⇒ page 37-133 .

37-140

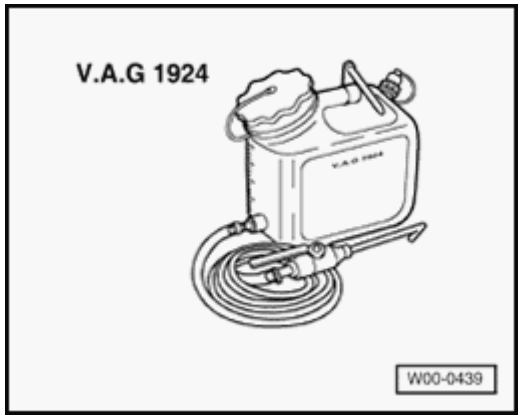
ATF, changing or topping off after repair work

- Engine switched off.

Special tools and equipment

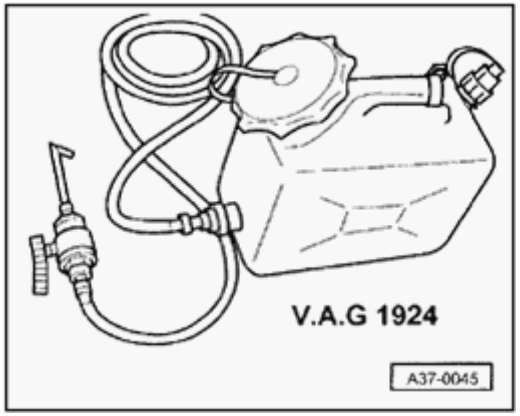


- VAG1306 drip tray



- VAG1924 ATF filler tool

37-141

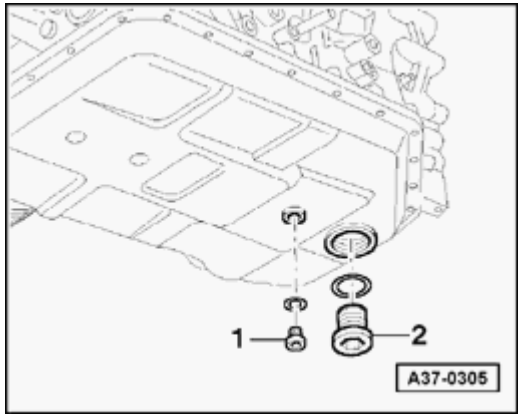


- Secure container of VAG1924 ATF filler tool as high up on vehicle as possible.
- Raise vehicle.

Notes:

- *Observe disposal regulations.*
- *Engine must not be started without ATF and vehicle must not be towed!*

- Place VAG1306 drip tray under transmission.



- Remove ATF drain plug -1- and drain ATF.

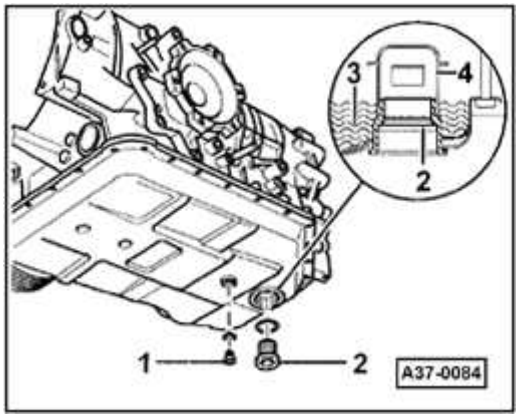
Note:

Drain plug and oil seal must both be replaced.

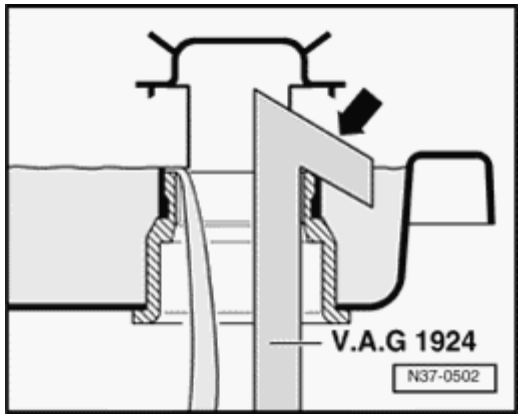
37-142

- Tighten ATF drain plug to 40 Nm.

- Remove ATF check plug -2-.



- Insert VAG1924 ATF filler tool into an opening -4- in the protective cap, but do not knock cap upward.

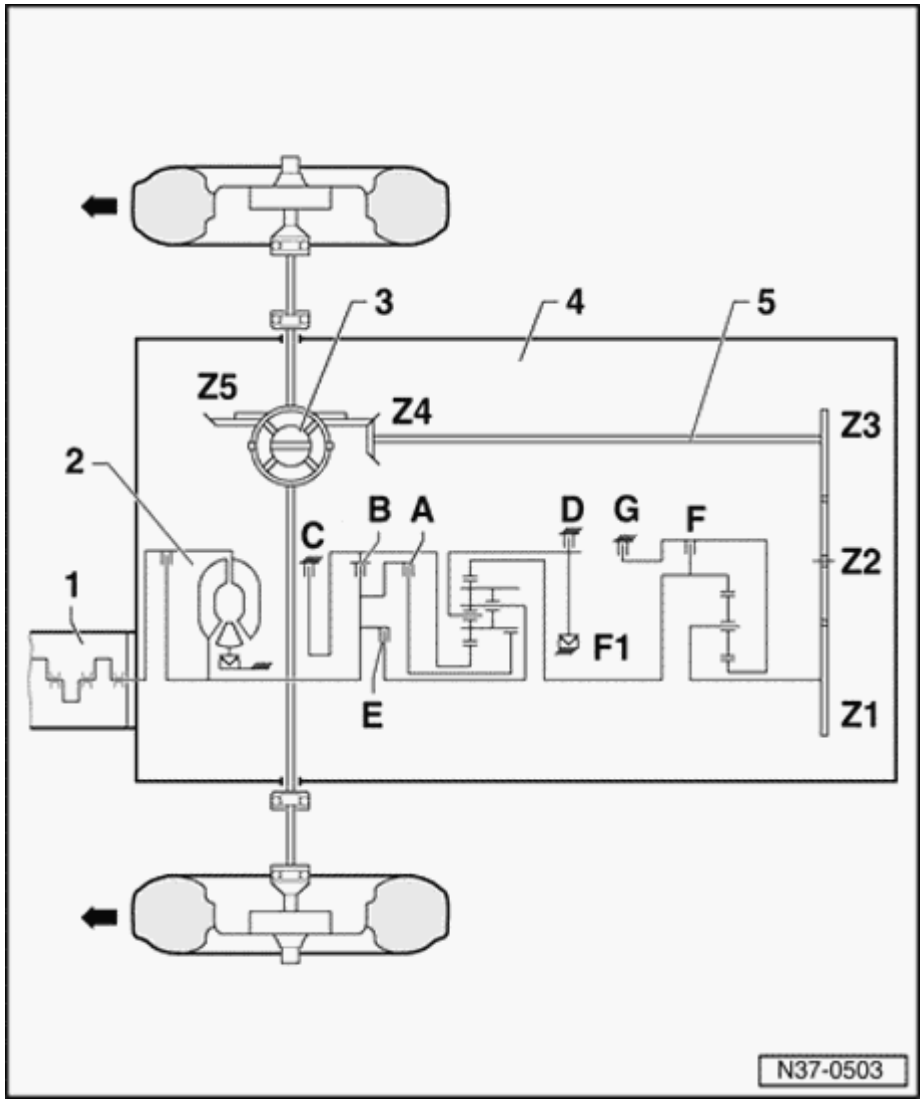


- Fill with ATF using VAG1924 ATF filler tool until ATF exits from the check hole.
- Shift selector lever into position "P".
- Start engine.
- Keeping the brake pedal depressed, shift into all selector lever positions at idle speed. Each position must remain selected for at least 10 seconds.
- Shift selector lever into position "P".
- Check ATF level and top off ⇒ Page 37-133 onward.

Note:

Observe all notes and test requirements for "Checking ATF level".

37-143



Power transfer, overview

Transmission diagram (Front Wheel Drive (FWD) vehicles)

A - Clutch A

B - Clutch B

E - Clutch E

F - Clutch F

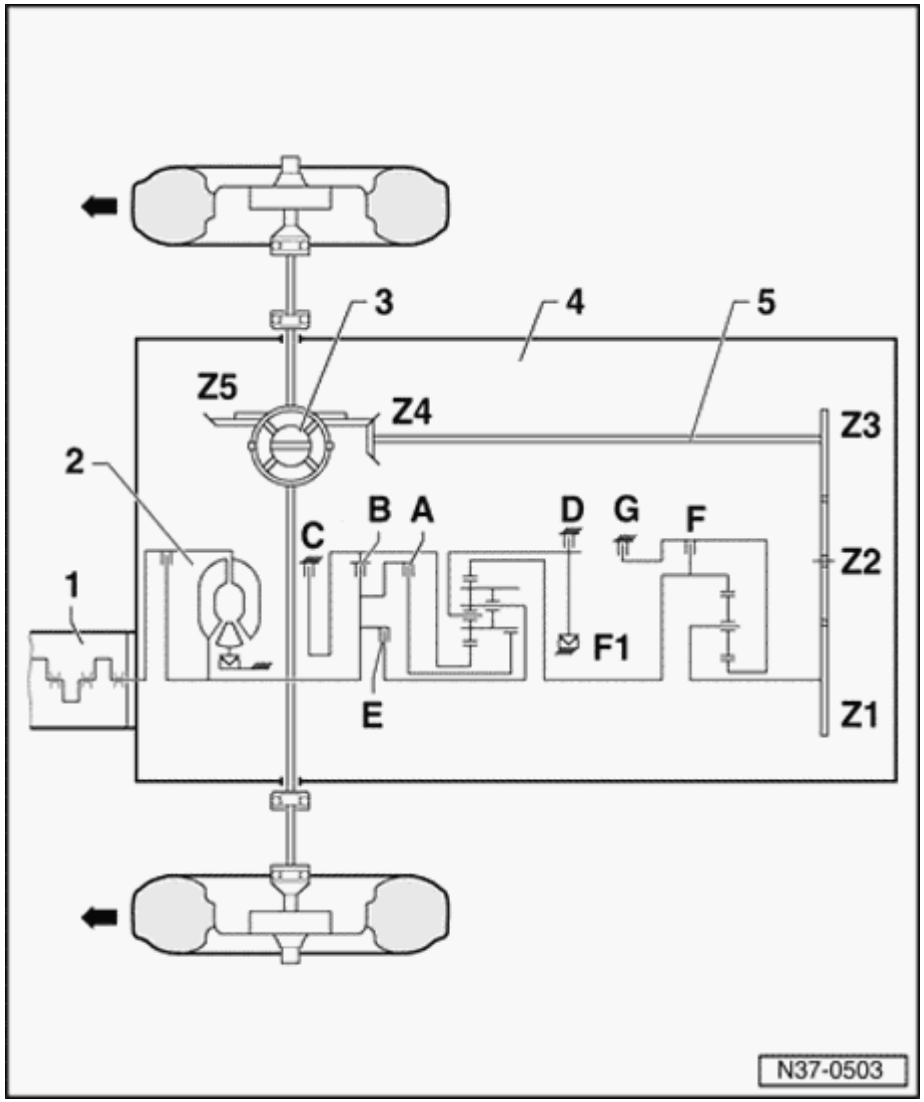
C - Brake C

D - Brake D

G - Brake G

F1 - Freewheel 1

37-144



1 - Engine

2 - Torque converter with lock-up clutch

3 - Differential

4 - Automatic transmission

5 - Drive pinion

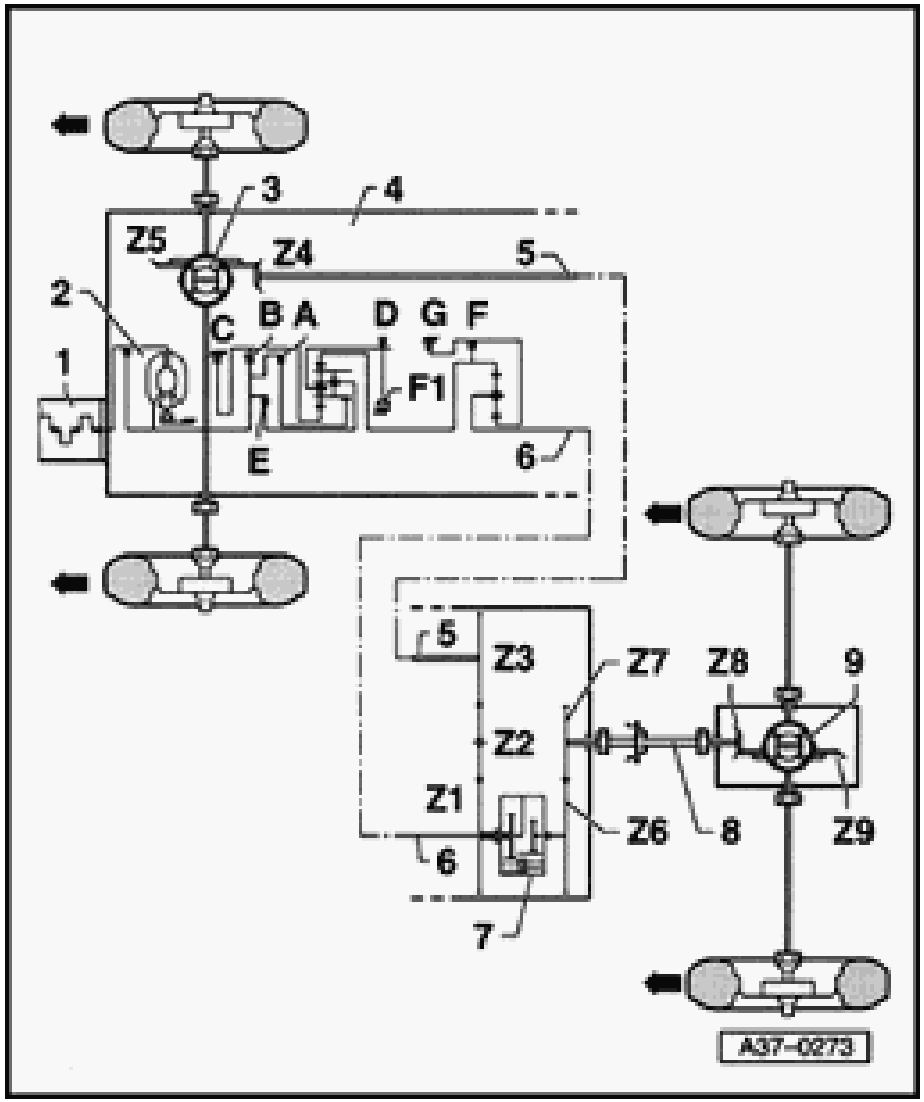
Z1, Z2 and Z3 = spur gears of intermediate drive; ratio ⇒ page 00-4

Z4, Z5 = ring gear, ratio ⇒ page 00-4

Note:

Arrows point in direction of travel.

37-145



Transmission diagram (All Wheel Drive (AWD) vehicles)

A - Clutch A

B - Clutch B

E - Clutch E

F - Clutch F

C - Brake C

D - Brake D

G - Brake G

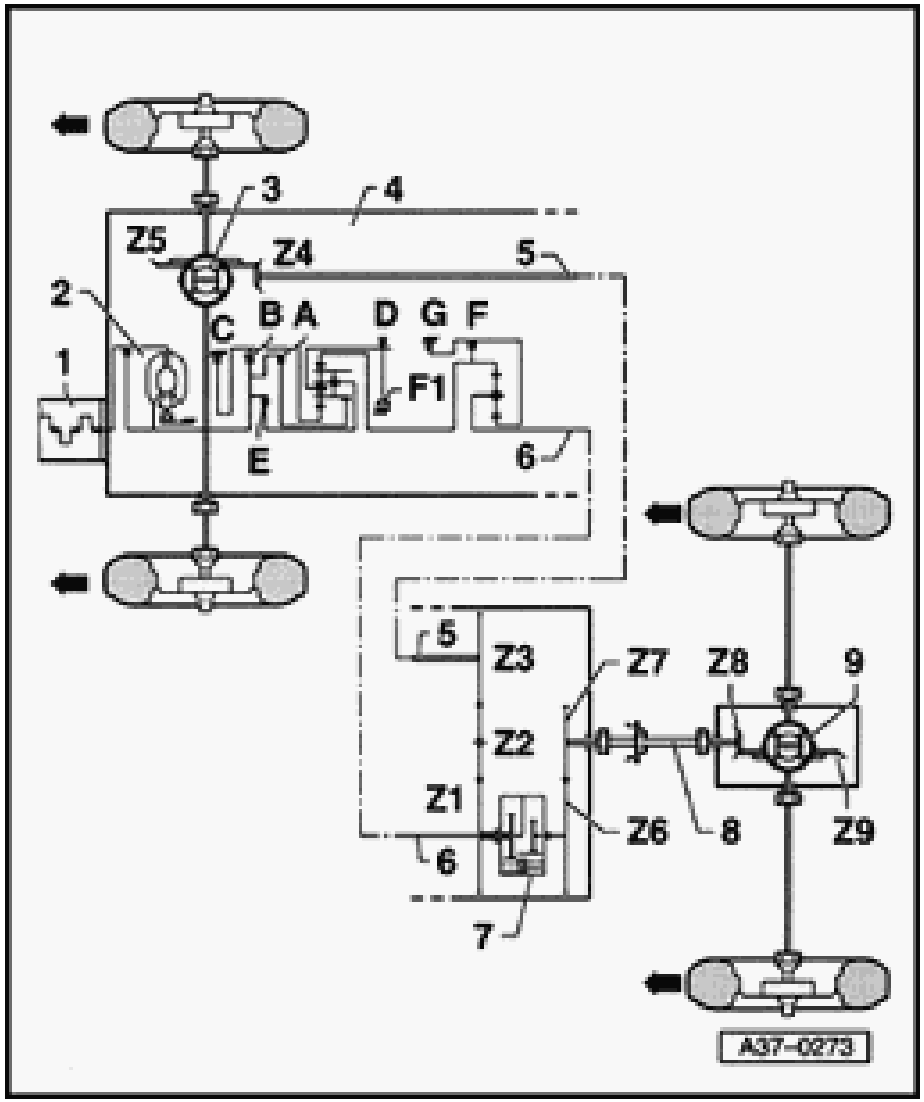
F1 - Freewheel 1

1 - Engine

2 - Torque converter with lock-up clutch

3 - Front differential

37-146



4 - Automatic transmission

5 - Drive pinion

6 - Output shaft

7 - Torsen differential

8 - Driveshaft

9 - Rear differential

Z1, Z2 and Z3 = spur gears of front intermediate drive; ratio ⇒ page 00-4

Z4, Z5 = front gear set; ratio ⇒ page 00-4

Z6, Z7 = spur gears of rear intermediate drive; ratio ⇒ page 00-10

Z8, Z9 = rear ring gear, ratio ⇒ page 00-10

Note:

Arrows point in direction of travel.

37-147

Shift element positions

- *When dealing with problems relating to poor acceleration and performance or general malfunctions, the following chart indicates which selector elements are actuated in the various gears. This should help to identify the selector elements that are not working properly.*

	Solenoid valves							Clutches							
	Solenoid valves			Pressure regulation valves				Clutch				Brake			Freewheel
Position / gear	1	2	3	1	2	3	4	A	B	E	F	C	D	G	1. Gear
R = Reverse	x			x		x			x				x	x	
N = Neutral	x	x		x		x								x	
D, 1st gear	x	x		x		x		x						x	x
D, 2nd gear	x	x		x	x	x		x				x		x	
D, 3rd gear		x	x - x	x	x			x			x	x			
D, 4th gear			x - x	x				x		x	x				
D, 5th gear	x		x - x	x	x					x	x	x			
2, 1. Gear	x			x		x		x					x	x	x
D, 5th to 4th gear	x		x	x	x		x	(x)		x	x	(x)			

- x = Component is actuated

- - = Component is not actuated

- (x) = Component actuation is dependent on driving condition

Transmission, disassembling and assembling

- Observe general repair instructions ⇒ page 00-27 .

Rules of cleanliness for working on automatic transmissions

- Thoroughly clean all connections and the surrounding area before disconnecting.
- Place parts that have been removed on a clean surface and cover. Use foils and paper. Use lint-free cloths only!
- Carefully cover over opened components or seal, if repairs are not carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation.
- Always replace O-rings, gaskets and sealing rings.
- Lightly lubricate O-rings before installing, this prevents the rings from being pinched when inserting.

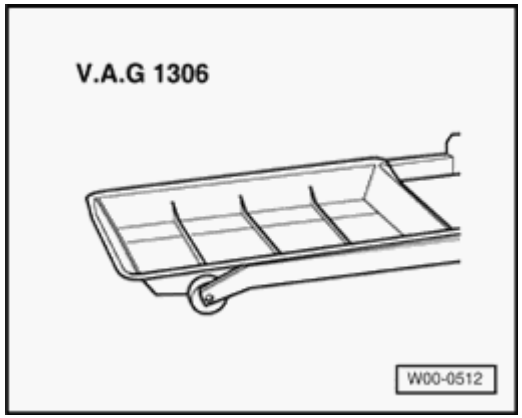
- Use only ATF in areas near ATF. Other lubricating substances cause functional problems in the hydraulic transmission control.

- Check the following fluid levels after installing, top off if necessary. ATF in planetary gear ⇒ page 37-133 , Gear oil in front final drive ⇒ page 39-1 , Transmission oil in center differential ⇒ page 39-40 . Capacities and specifications ⇒ Page 00-22 onward.

37-149

ATF lines, removing and installing overview

Special tools and equipment



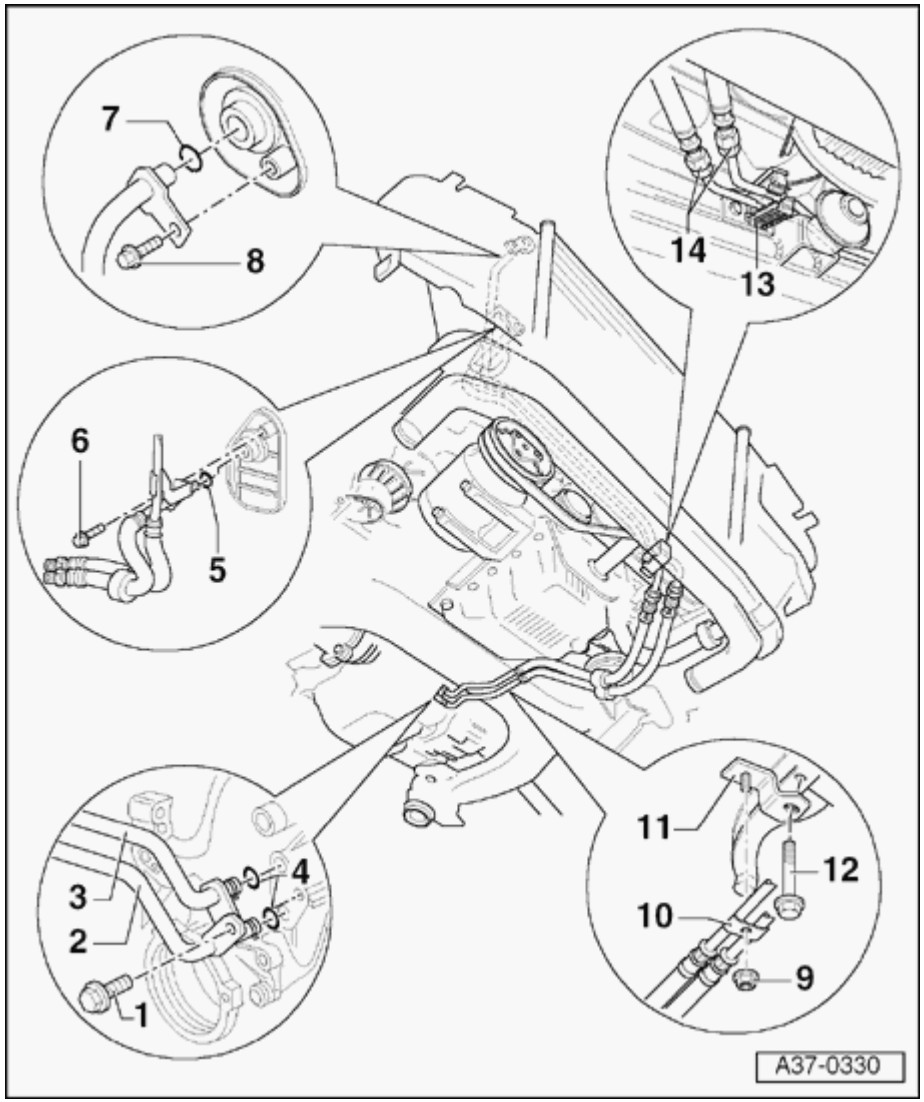
- VAG1306 drip tray

Removing and installing ATF lines for 4 cylinder gasoline engines ⇒ page 37-150

Removing and installing ATF lines for 6 cylinder gasoline engines except for 2.7 Liter 5V turbo ⇒ page 37-152

Removing and installing ATF lines for 6 cylinder 2.7 Liter 5V turbo ⇒ page 37-154

37-150



ATF lines, removing and installing, (vehicles with 4 cyl. engine)

Notes:

- *Place VAG1306 drip tray underneath.*

1 - Bolt (21Nm)

- Insert line until impact by hand before tightening

2 - Oil line to cooler

- Note marking on transmission housing

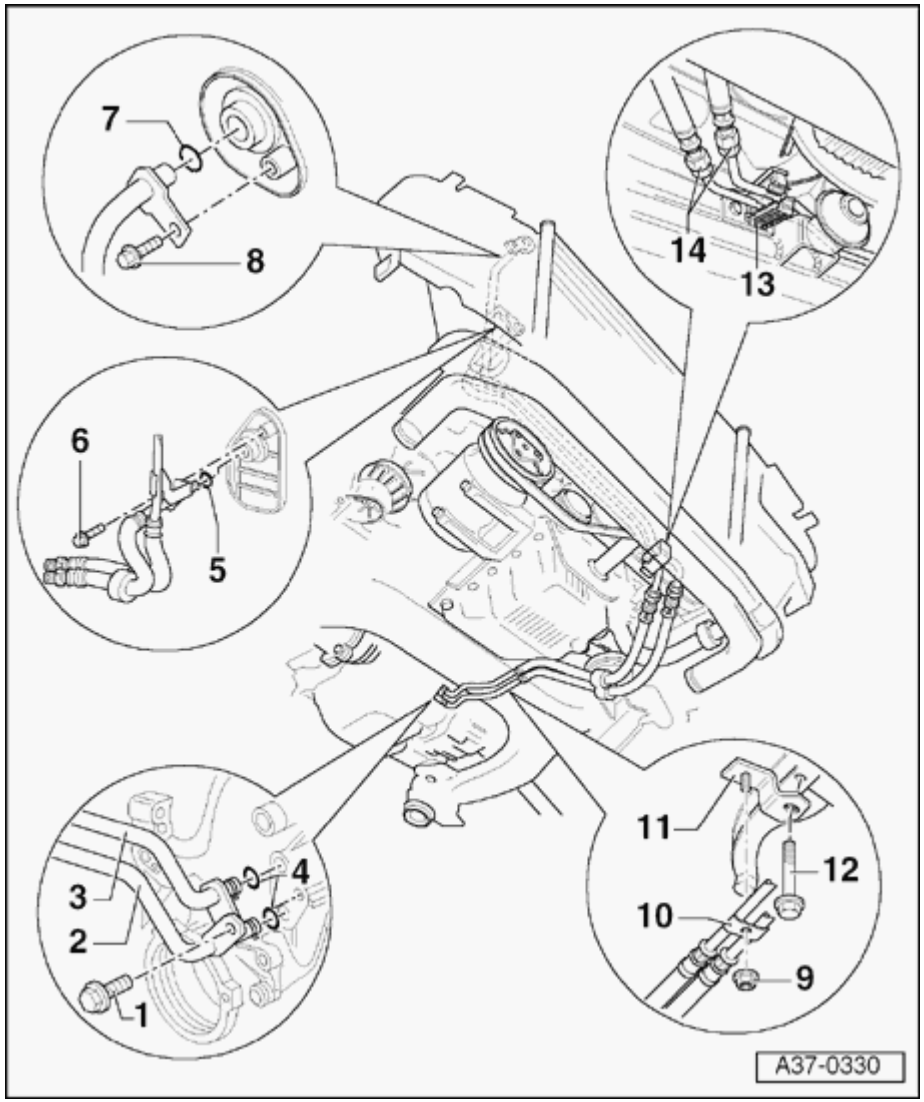
3 - Oil line from cooler

- Note marking on transmission housing

4 - O-ring

- Apply ATF when inserting
- Always replace

37-151



5 - O-ring

- Apply ATF when inserting
- Always replace

6 - Bolt (5Nm)

7 - O-ring

- Apply ATF when inserting
- Always replace

8 - Bolt (5Nm)

9 - Nut (5 Nm)

10 - Clamp

11 - Bracket

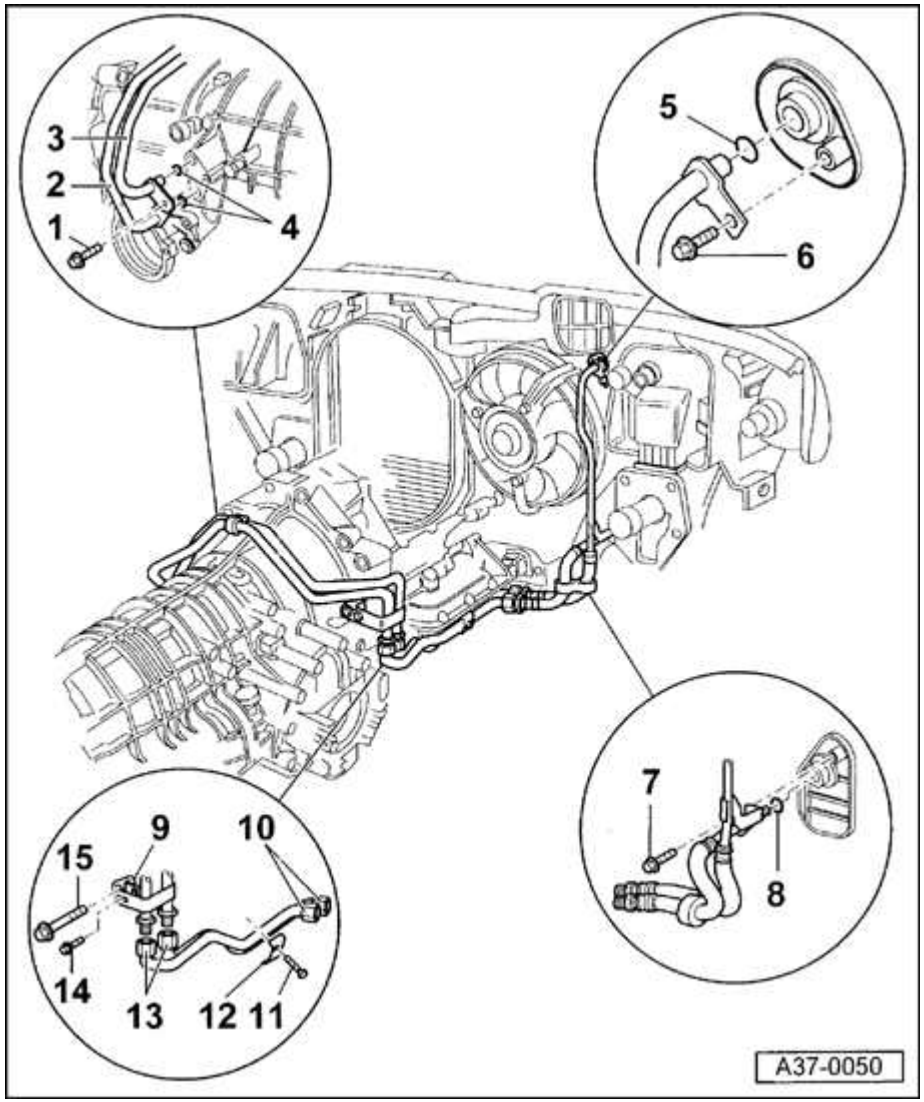
12 - Bolt (5Nm)

- Does not need to be removed when removing and installing ATF lines

13 - Clip bracket

14 - Union nut, 30 Nm

37-152



ATF lines, removing and installing, (vehicles with 6 cyl. engine)

Notes:

- *Place VAG1306 drip tray underneath.*

1 - Bolt (21Nm)

- Insert line until impact by hand before tightening

2 - Oil line from cooler

- Note marking on transmission housing

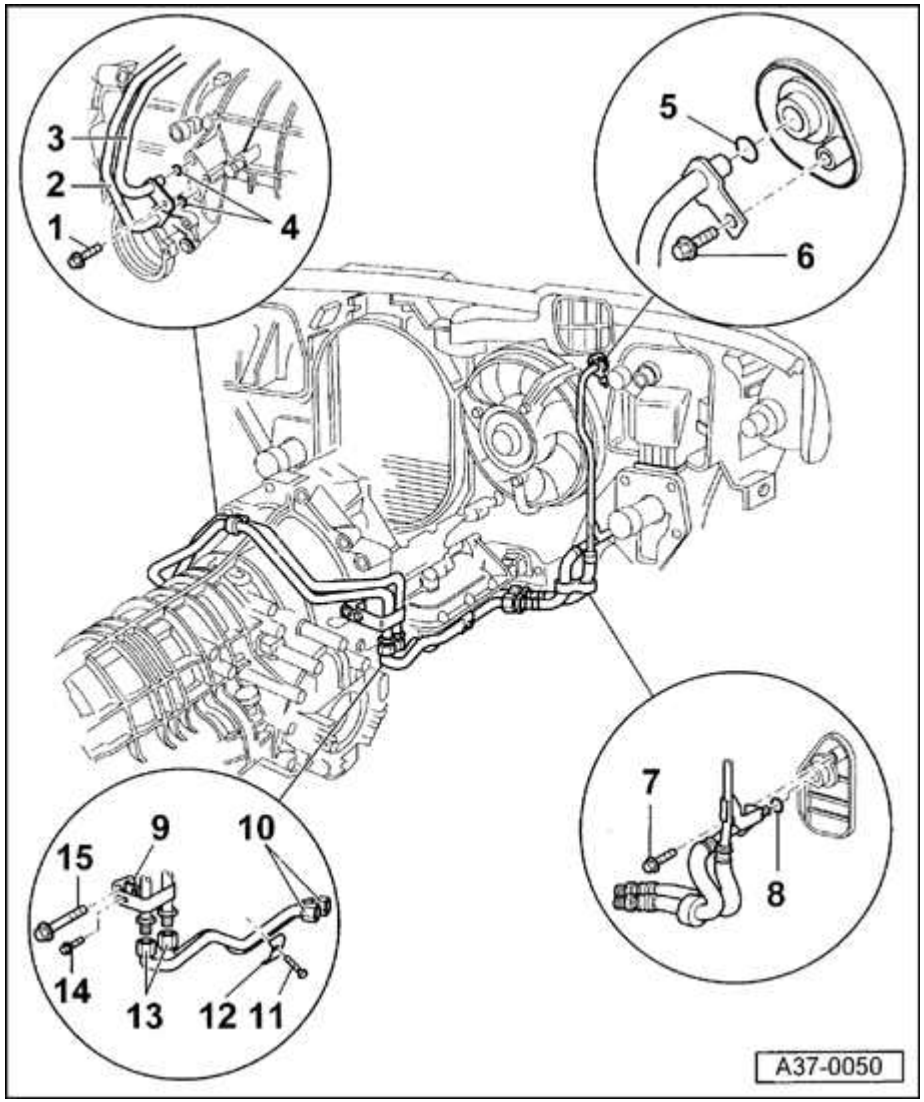
3 - Oil line to cooler

- Note marking on transmission housing

4 - O-ring

- Apply ATF when inserting
- Always replace

37-153



5 - O-ring

- Apply ATF when inserting
- Always replace

6 - Bolt (5Nm)

7 - Bolt (5Nm)

8 - O-ring

- Apply ATF when inserting
- Always replace

9 - Bracket

10 - Union nut, 25 Nm

11 - Hex bolt, 5 Nm

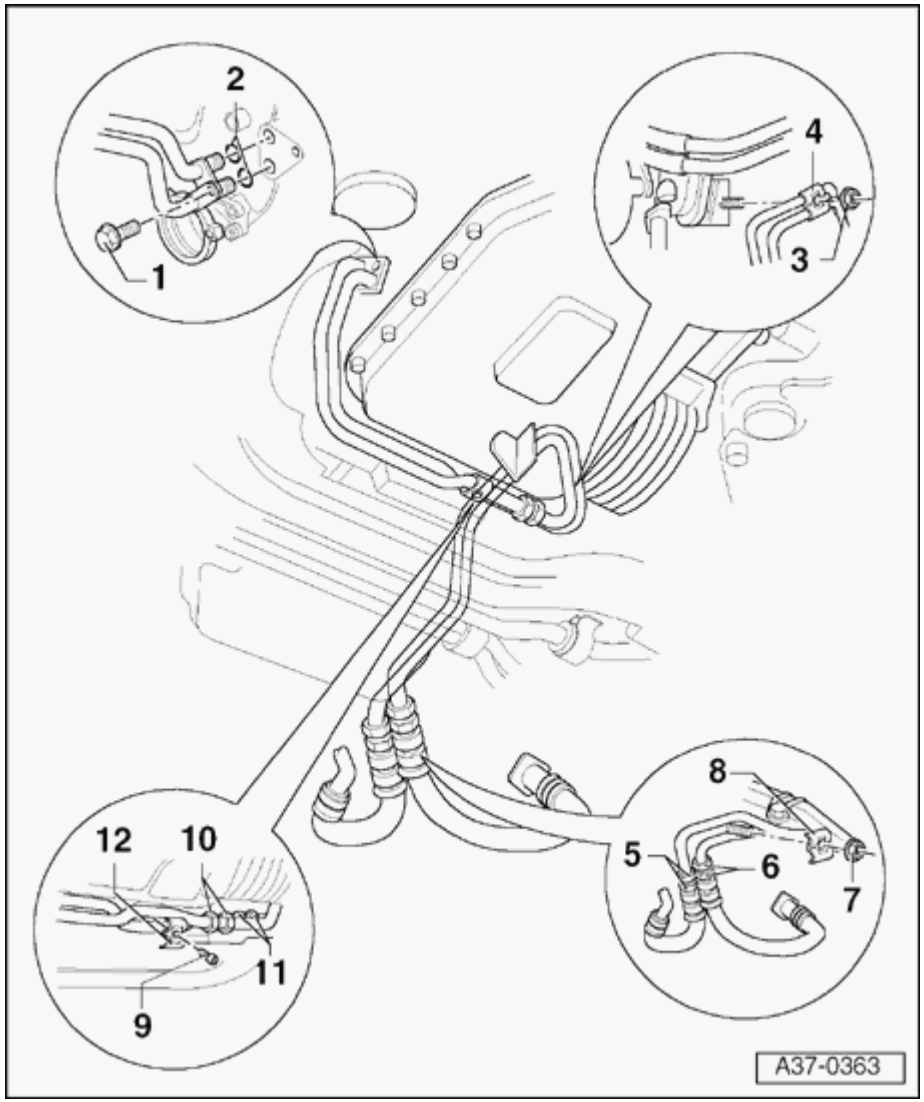
12 - Clamp

13 - Union nut, 25 Nm

14 - Hex bolt, 10 Nm

15 - Hex bolt, 65 Nm

37-154



ATF lines, removing and installing (vehicles with 6 cylinder 2.7 Liter 5V turbo engine)

Notes:

- *Place VAG1306 drip tray underneath.*

1 - Bolt (21Nm)

- Insert line until impact by hand before tightening

2 - O-ring

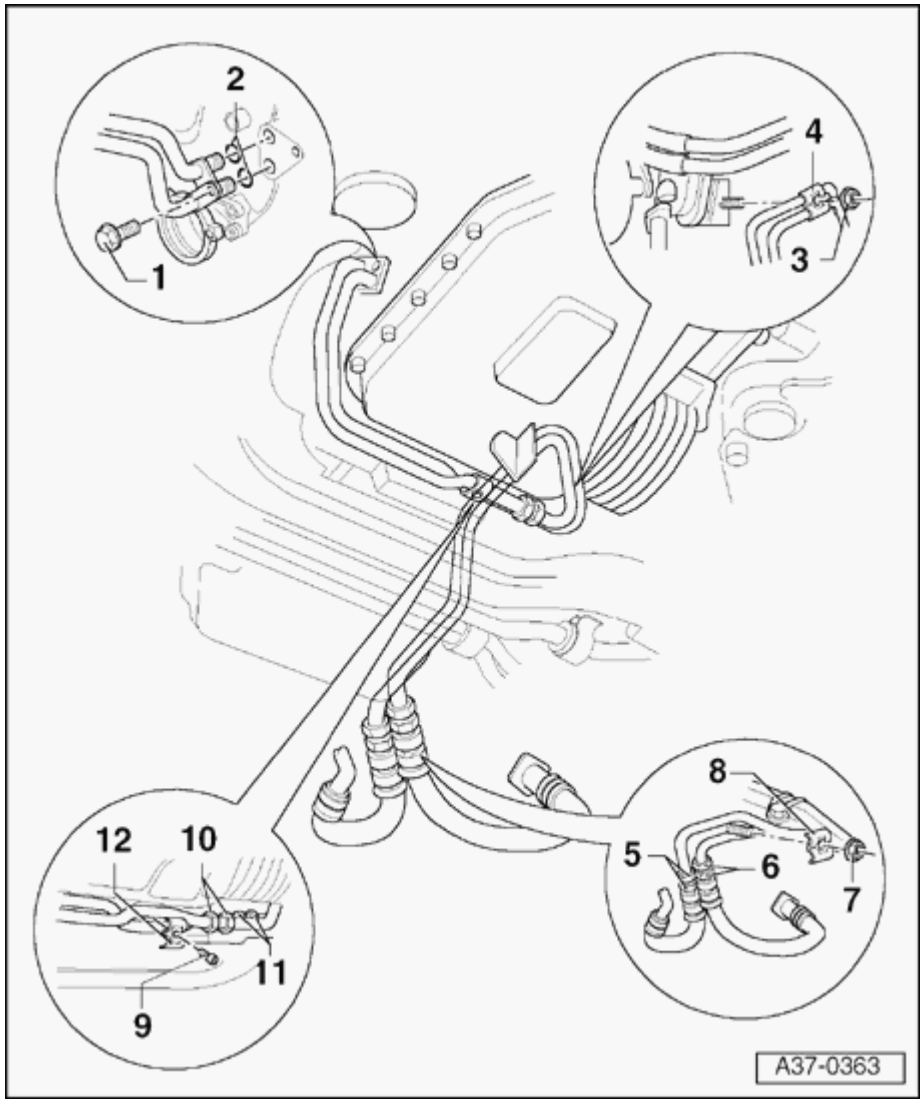
- Apply ATF when inserting
- Always replace

3 - Nut - 5 Nm

4 - Clamp

5 - Union nut, 29 Nm

37-155



6 - Union nut, 29 Nm

- Note yellow markings for allocation of lines.

7 - Nut - 5 Nm

8 - Clamp

9 - Bolt (5Nm)

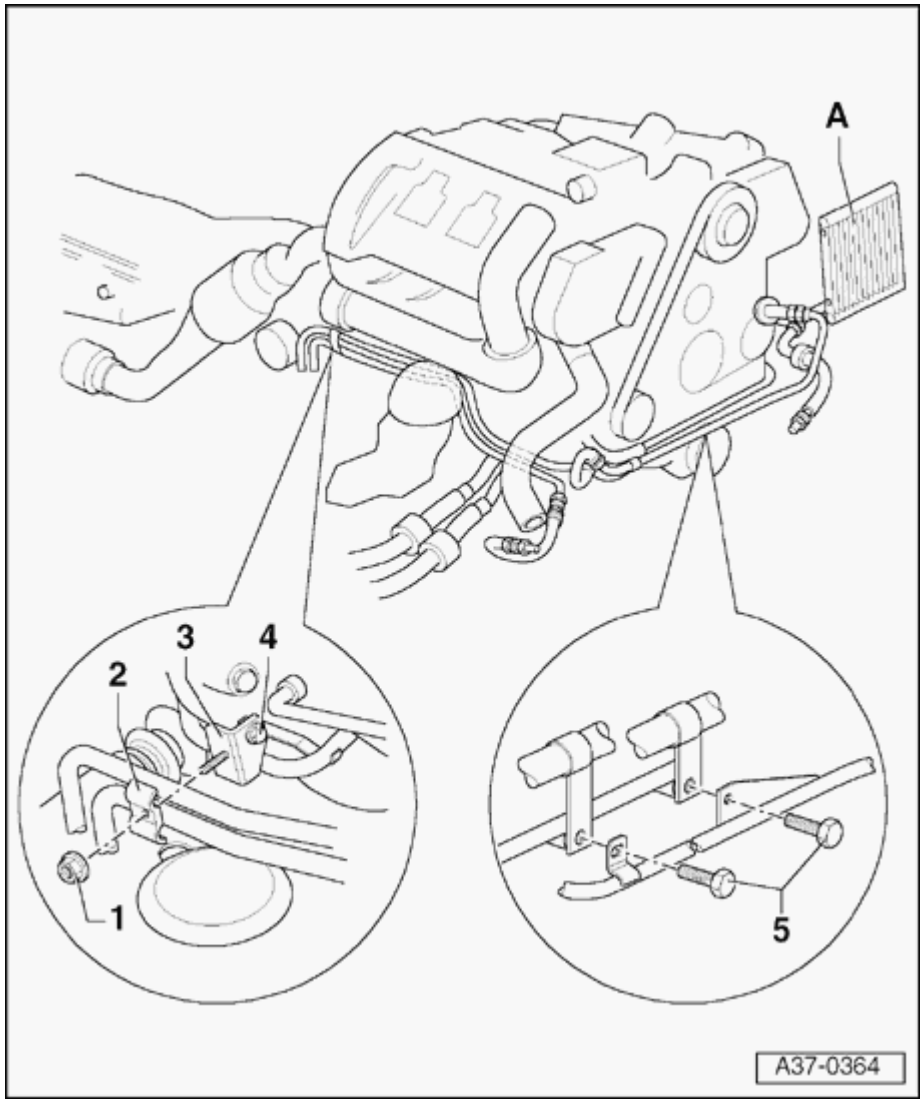
10 - Union nut, 29 Nm

- Note yellow markings for allocation of lines.

11 - Union nut, 29 Nm

12 - Clamp

37-156



1 - Nut - 9.5 Nm

2 - Clamp

3 - Bracket

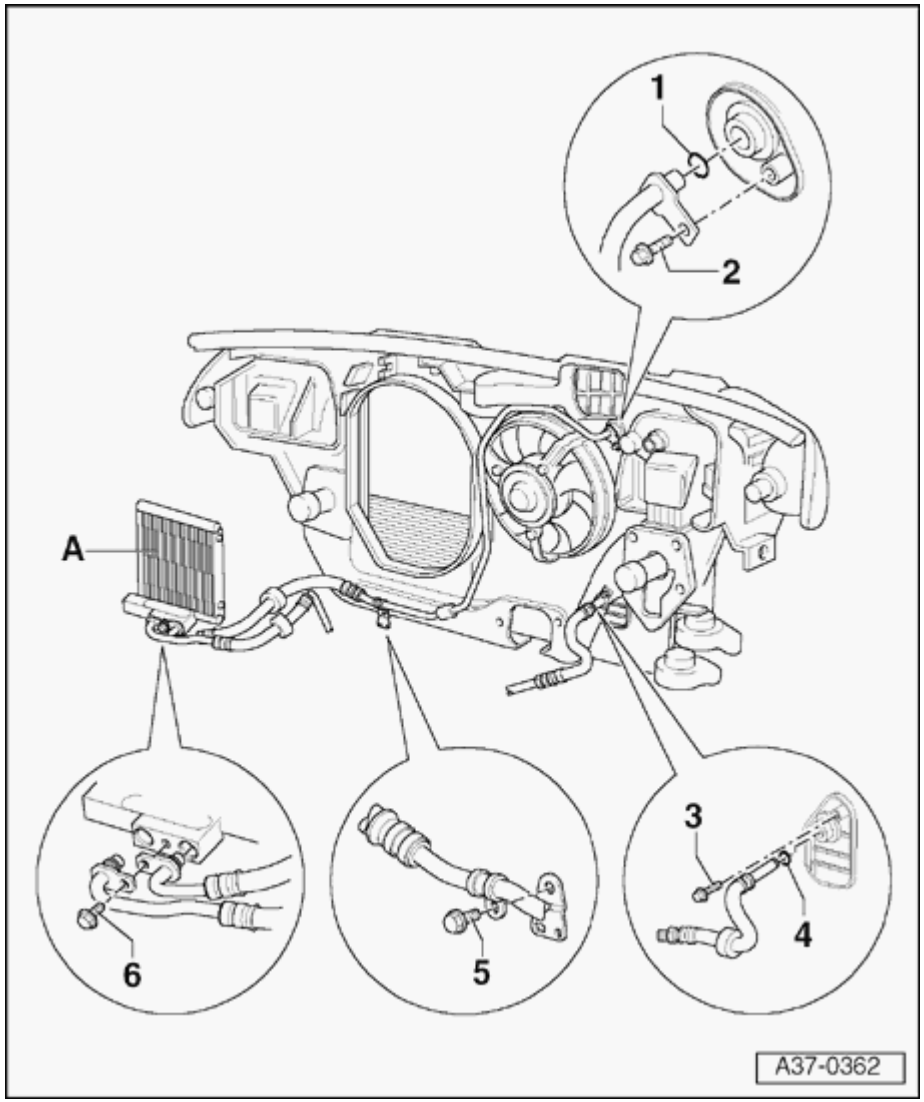
4 - Bolt - 9.5 Nm

5 - Bolt - 22 Nm

A - Auxiliary ATF cooler

- An extra ATF check must be performed after replacing or emptying the auxiliary ATF cooler ⇒ page 37-138

37-157



A - Auxiliary ATF cooler

- An extra ATF check must be performed after replacing or emptying the auxiliary ATF cooler
  ⇒ page 37-138

1 - O-ring

- Apply ATF when inserting
- Always replace

2 - Bolt (5Nm)

3 - Bolt (5Nm)

4 - O-ring

- Apply ATF when inserting
- Always replace

5 - Bolt - 10 Nm

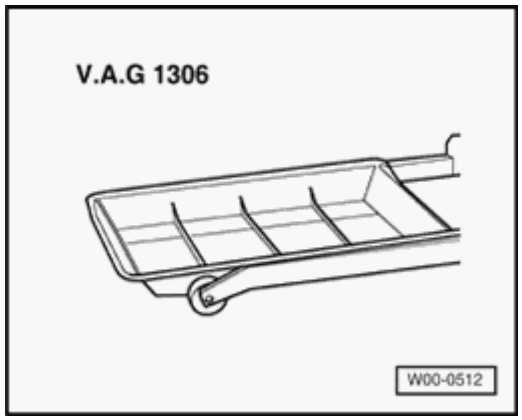
6 - Bolt (25Nm)

- Before tightening, insert lines by hand up to stop

37-158

ATF lines and ATF cooler, cleaning

Special tools and equipment



- VAG1306 drip tray
- Hose, approx. 18 mm
- Compressed air gun, standard
- Protective glasses

Notes:

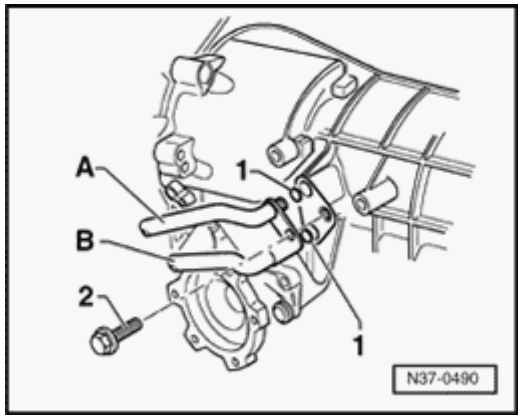
- *Always blow compressed air through oil cooler and ATF lines (max. 10 mbar) before installing a replacement transmission.*
- *When installing ATF lines, insert into transmission or cooler by hand until impact first and then tighten bolts.*

WARNING!

Wear protective glasses.

- Place VAG1306 drip tray underneath.

37-159



- Remove bolt -2-.
- Disconnect ATF lines from transmission.
- Slide a hose with approx. 18 mm diameter onto ATF line -A- and secure with hose clamp. Place the other end of the hose into an appropriate container.
- Blow through ATF line -B- with compressed air gun.
- Change hose from ATF line -A- to ATF line -B- and repeat procedure.
- Re-secure ATF lines.
- Then check ATF level and top off ⇒ Page 37-133 onward.

38-1

Oil pan, oil strainer and valve body, removing and installing

WARNING!

Do not run engine with the oil pan removed or without ATF filling and do not tow vehicle.

Notes:

- *Always replace a soiled or faulty valve body.*
- *Rules of cleanliness for working on automatic transmissions ⇒ page 37-148 .*
- *General repair notes ⇒ page 00-27 .*
- *Coat O-rings and sealing rings with ATF. Other lubricating substances lead to functional problems in the hydraulic transmission control.*

Removed parts, overview

Notes:

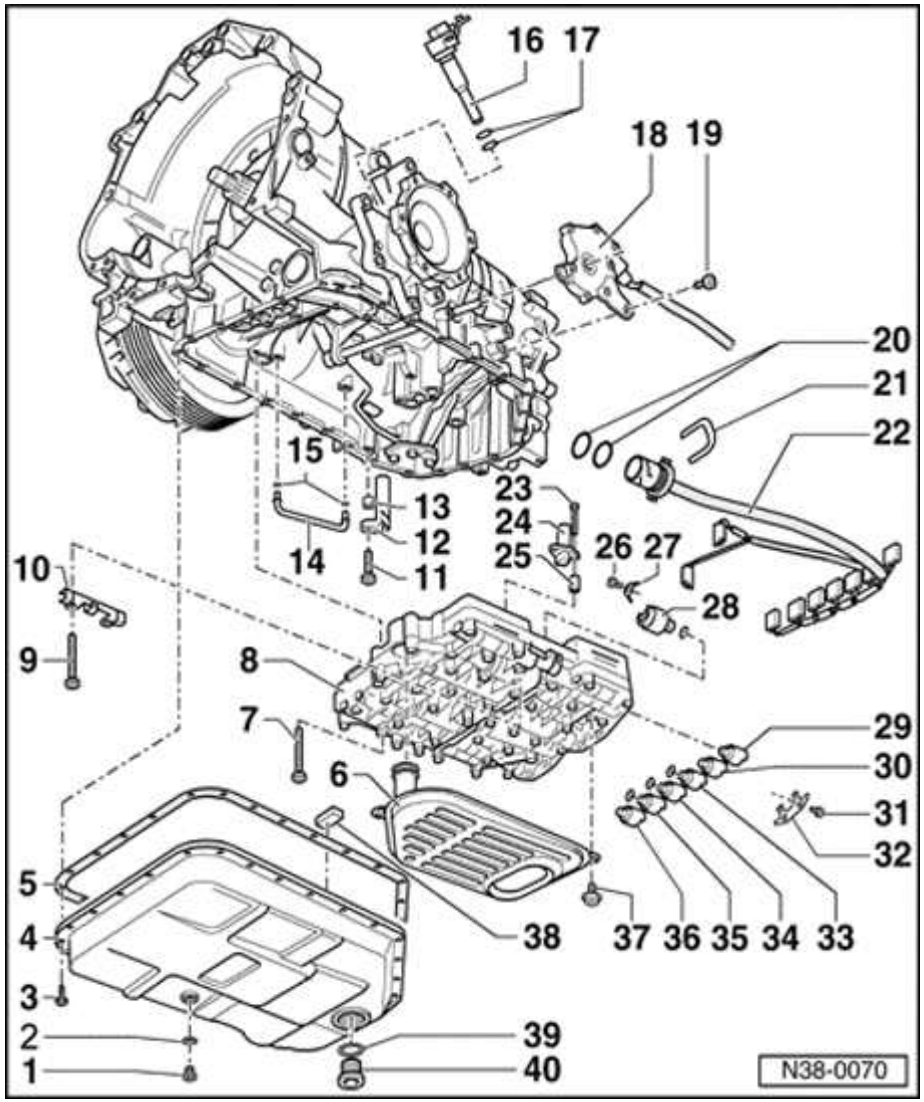
- *There is a distinction made between two types of transmission. Transmissions with hydraulic control E17, the sensor for transmission RPM (inductive sensor) is secured to bottom of valve body. Transmissions with hydraulic control E18/2, the sensor for transmission RPM (hall effect sensor) is secured to transmission housing behind valve body.*

- *Information regarding which transmission is installed can be found in tables ⇒ Page 00-4 onward.*

Overview of the removed parts for transmission with Park/Neutral Position (PNP) Switch -E17- ⇒ page 38-3

Overview of the removed parts for transmission with hydraulic control E18/2 ⇒ page 38-11

38-3



Overview of the removed parts for transmission with Park/Neutral Position (PNP) Switch -E17-

1 - Drain plug - 40 Nm

- 5 mm socket-head bolt
- Remove to drain ATF ⇒ page 38-20

2 - Seal

- Always replace

3 - Bolt - 10 Nm

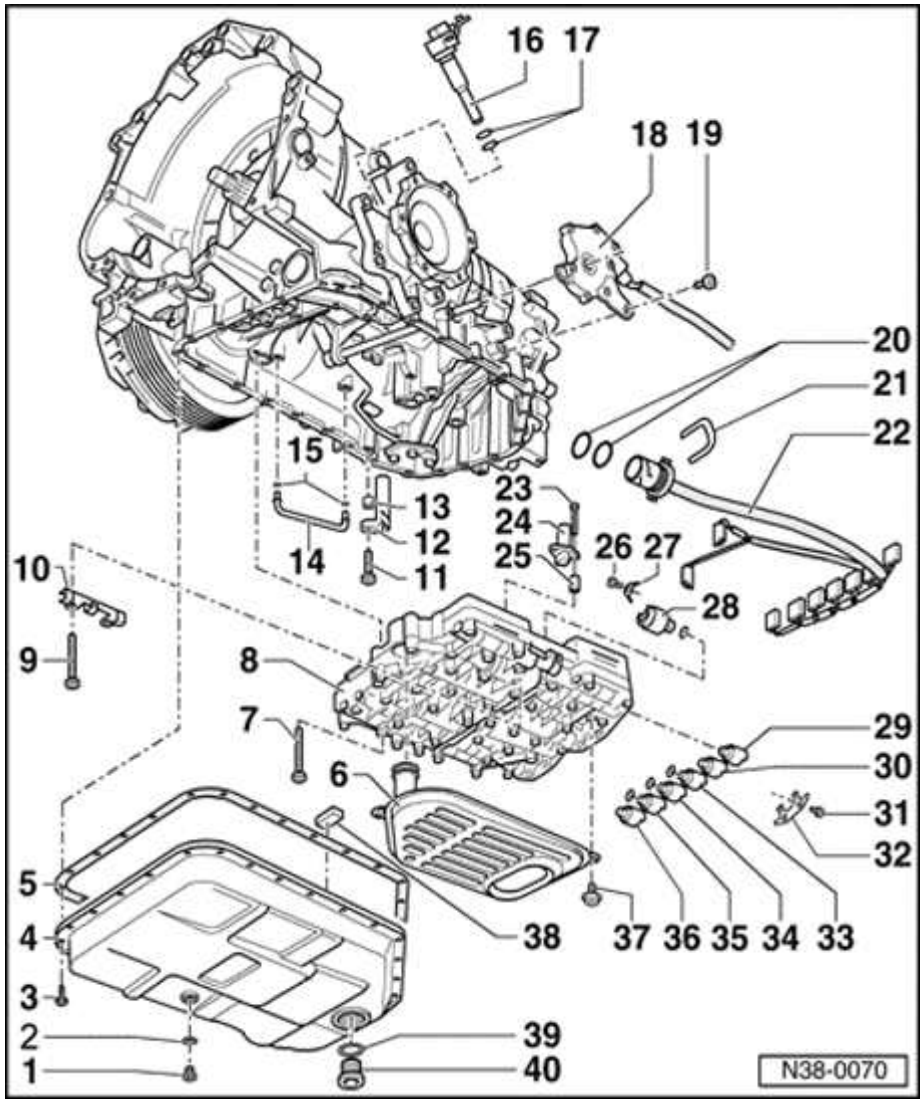
- Tighten bolts for oil pan in several stages in diagonal sequence

4 - Oil pan

- Removing and installing ⇒ page 38-19

5 - Gasket

- Always replace



6 - ATF-strainer

- Removing and installing ⇒ page 38-21

7 - Bolt - 8 Nm

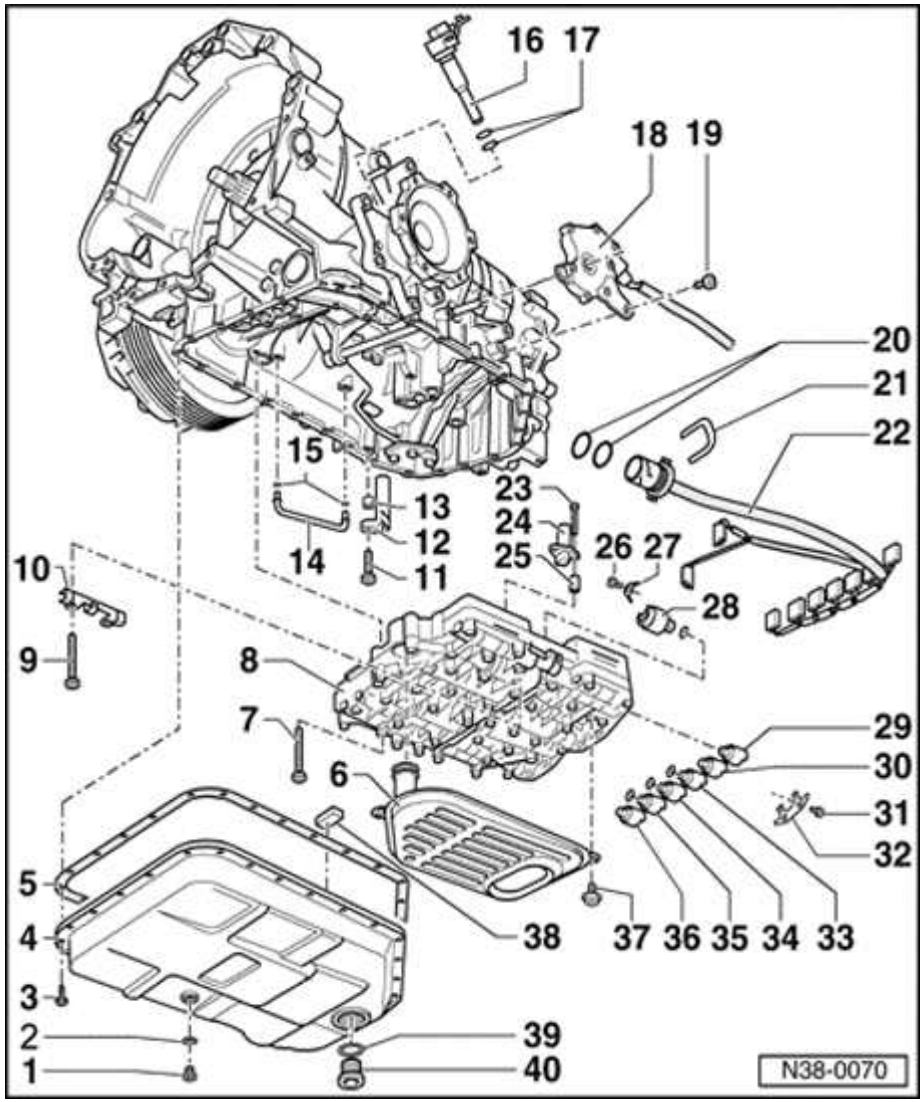
- For mounting valve body: 1 bolt M6 x 30, 16 bolts M6 x 60
- Observe tightening sequence ⇒ page 38-26

8 - Valve body

- Removing and installing ⇒ page 38-22
- Allocation according to transmission code letters

⇒ *Parts Catalog*

9 - Bolt - 8 Nm



10 - Bracket

- For wiring harness
- Hook in wiring harness
- Mounted with valve body bolts

11 - Bolt - 6 Nm

12 - Transmission Vehicle Speed Sensor (VSS) -G38-

- Removing and installing ⇒ page 38-40

13 - Spacer sleeve

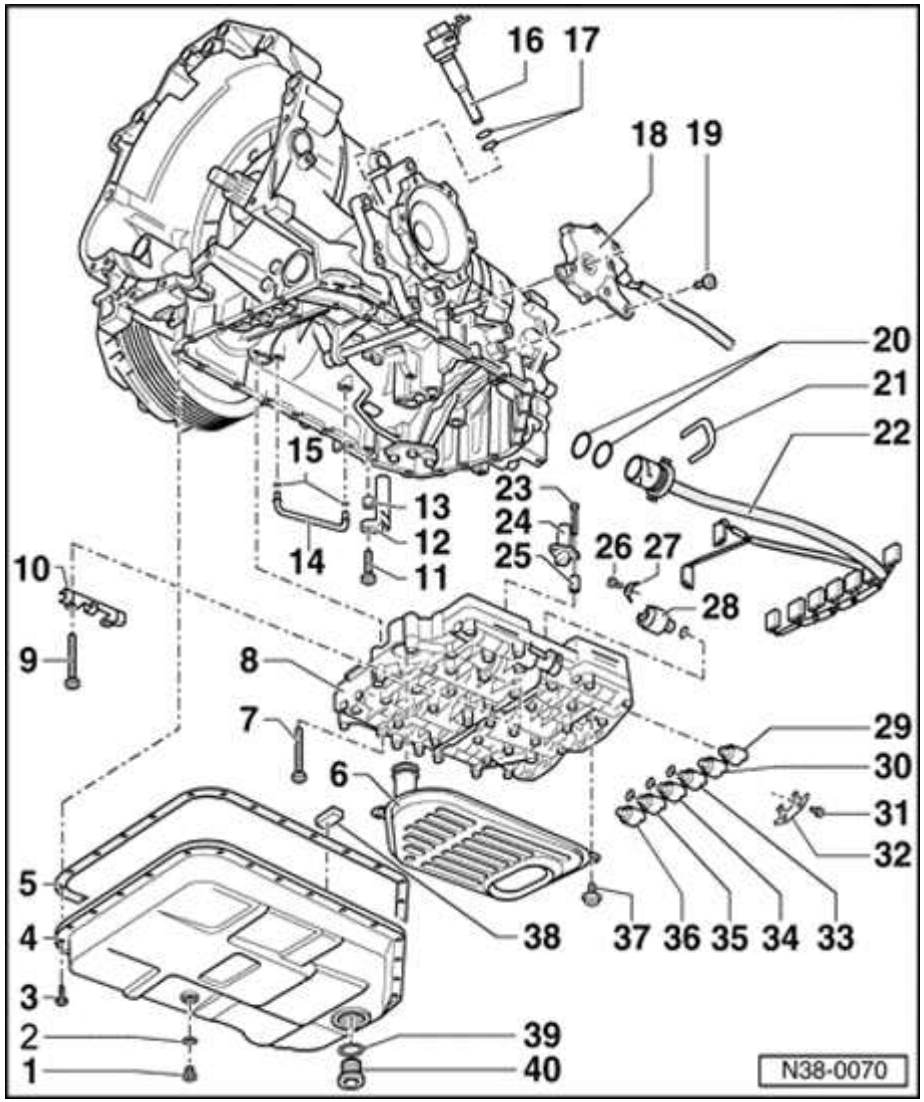
- Height: 8 mm

14 - Inner oil line

- Always replace
- Removing and installing ⇒ page 38-29

15 - O-ring

- Always replace



16 - Speedometer Vehicle Speed Sensor (VSS) -G22-

- Removing and installing ⇒ page 38-35

17 - O-ring

- Always replace
- Coat with Vaseline

18 - Multi-Function Transmission Range (TR) Switch -F125-

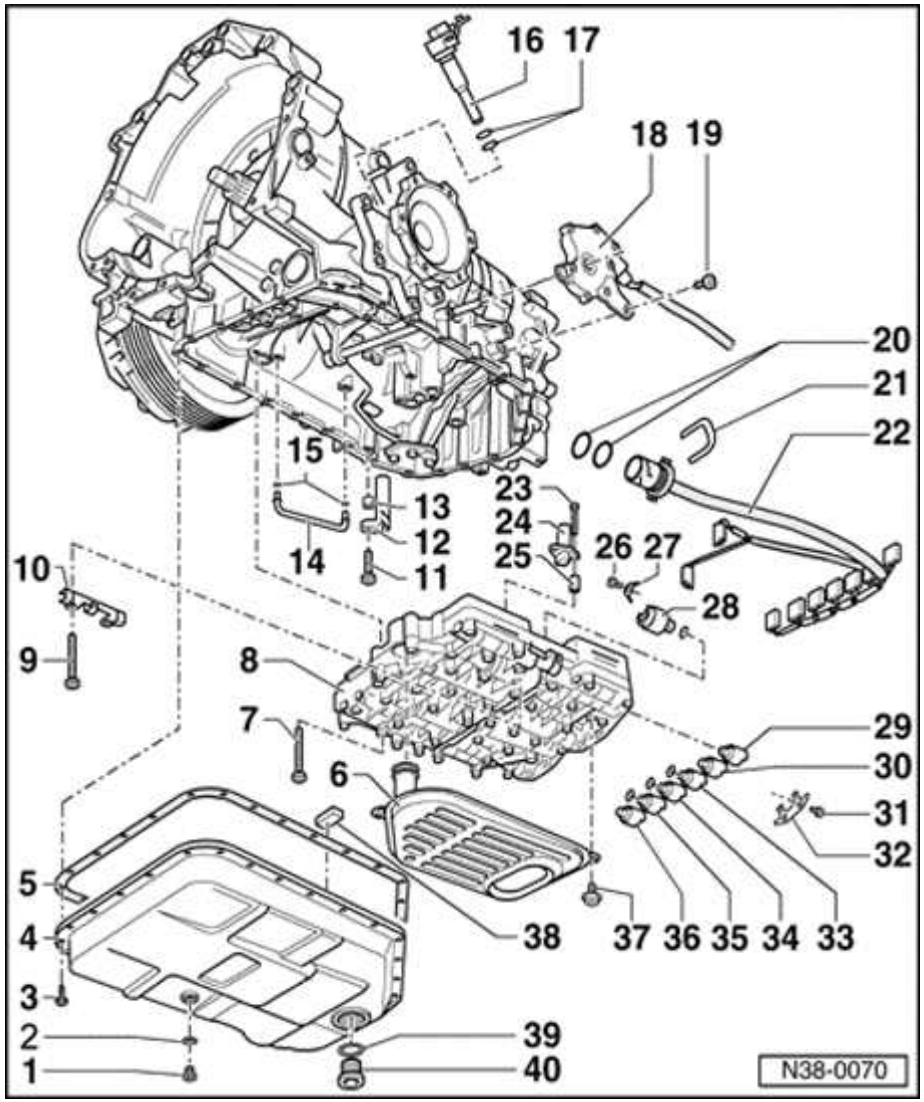
- Removing and installing ⇒ page 38-33
- Replacing shift rod sealing ring ⇒ page 38-31

19 - Bolt - 8 Nm

20 - O-ring

- Always replace

21 - Locking clamp



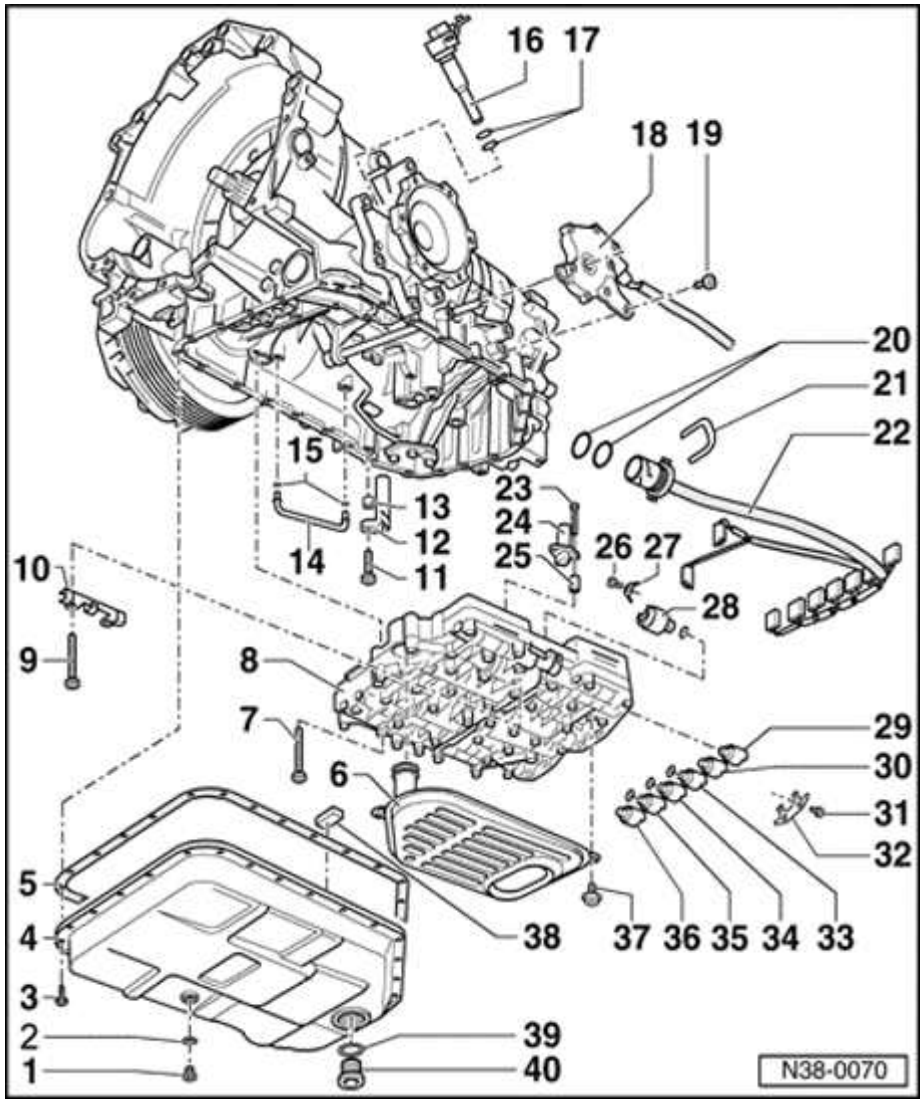
22 - Wiring harness

- Always replace ⇒ page 38-42
- Transmission Fluid Temperature Sensor - G93- is integrated into the wiring harness
- Remove and install valve body to install ⇒ page 38-22
- Unhook from bracket for wiring harness, item 10
- Installation position wiring harness connector: Flat part of rear collar points toward oil pan, the tabs at collar are horizontal

23 - Bolt - 6 Nm

24 - Sensor for transmission RPM -G182-

- Removing and installing ⇒ page 38-36



25 - Spacer sleeve

- Height: 20 mm

26 - Bolt - 6 Nm

27 - Bracket

- For solenoid valve

28 - Solenoid Valve 4 -N91-

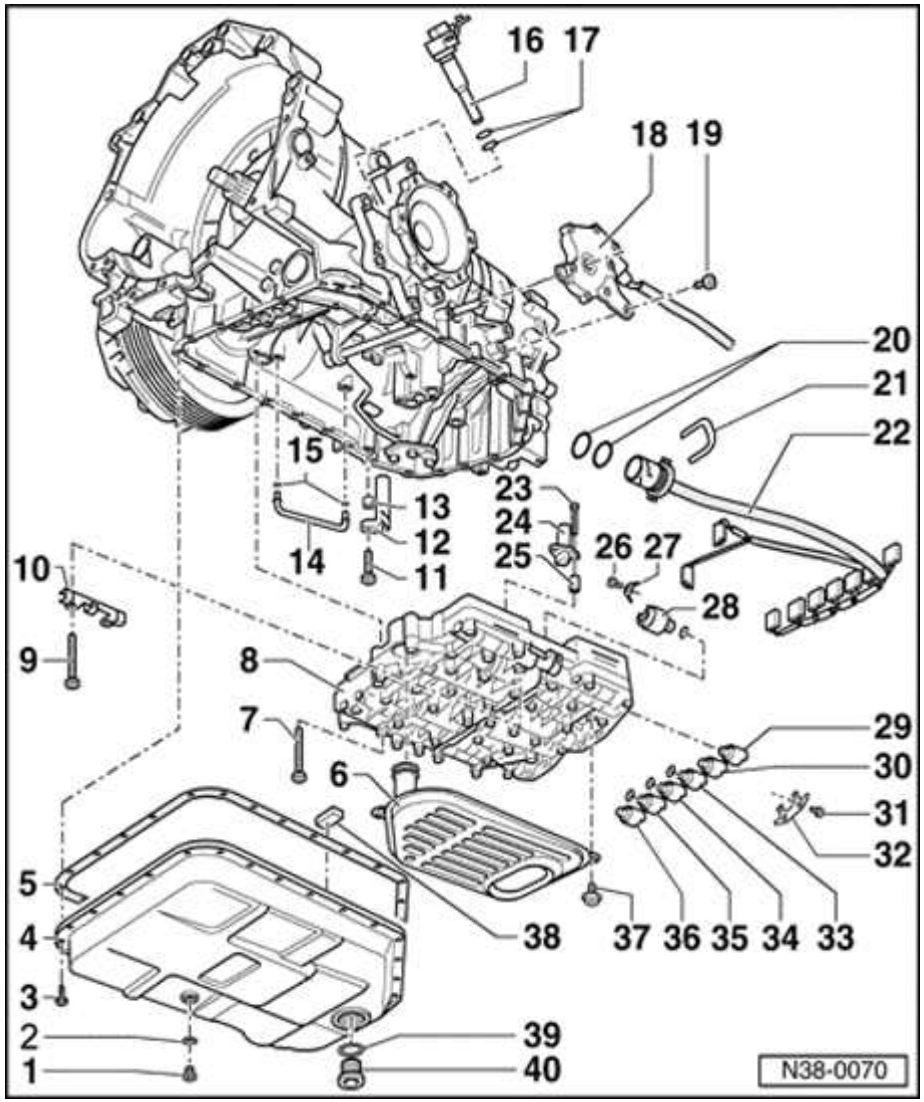
- With O-ring
- Remove and install valve body to install ⇒ page 38-22

29 - Solenoid valve 3 -N90-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19

30 - Solenoid valve 2 -N89-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19



31 - Bolt - 6 Nm

32 - Bracket

- For solenoid valves

33 - Solenoid Valve 6 -N93-

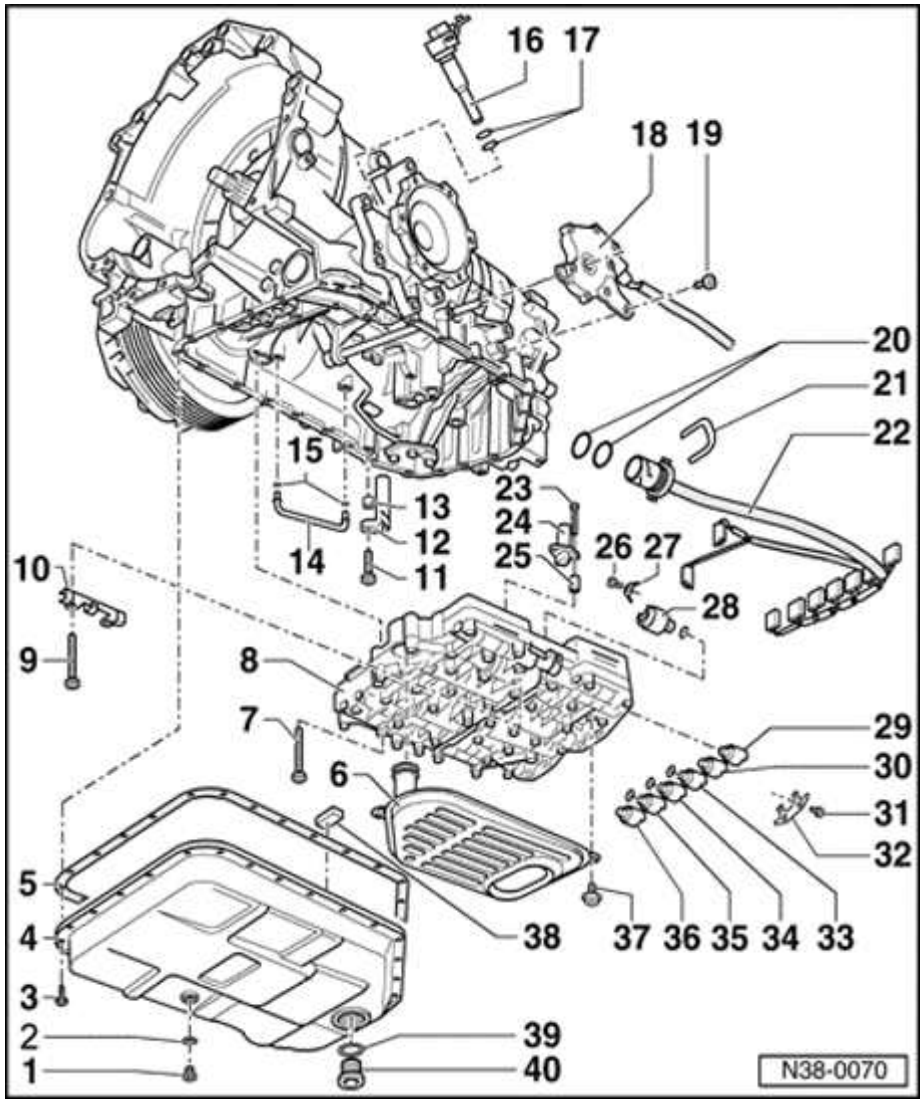
- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19

34 - Solenoid Valve 7 -N94-

- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19

35 - Solenoid valve 5 -N92-

- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19



36 - Solenoid valve 1 -N88-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19 and unbolt guide plate for park locking mechanism
- When installing, do not tighten bolts for guide plate (23 Nm) in selector lever position "P".

37 - Bolt - 6 Nm

38 - Magnet

- 4 pieces in the oil pan recesses

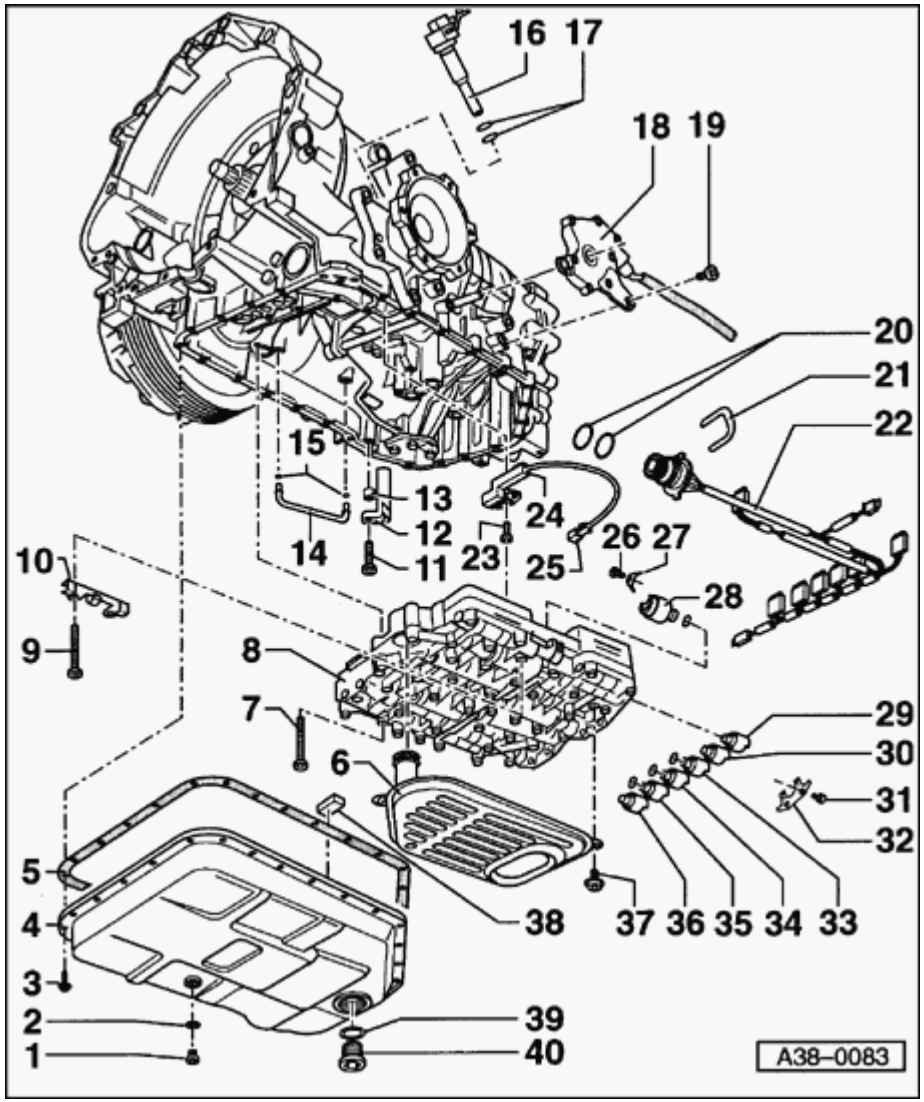
39 - O-ring

- Always replace

40 - ATF check plug - 80 Nm

- 17 mm socket-head bolt

38-11



Overview of the removed parts for transmission with hydraulic control E18/2

1 - Drain plug - 40 Nm

- 5 mm socket-head bolt
- Remove to drain ATF ⇒ page 38-20

2 - Seal

- Always replace

3 - Bolt - 10 Nm

- Tighten bolts for oil pan in several stages in diagonal sequence

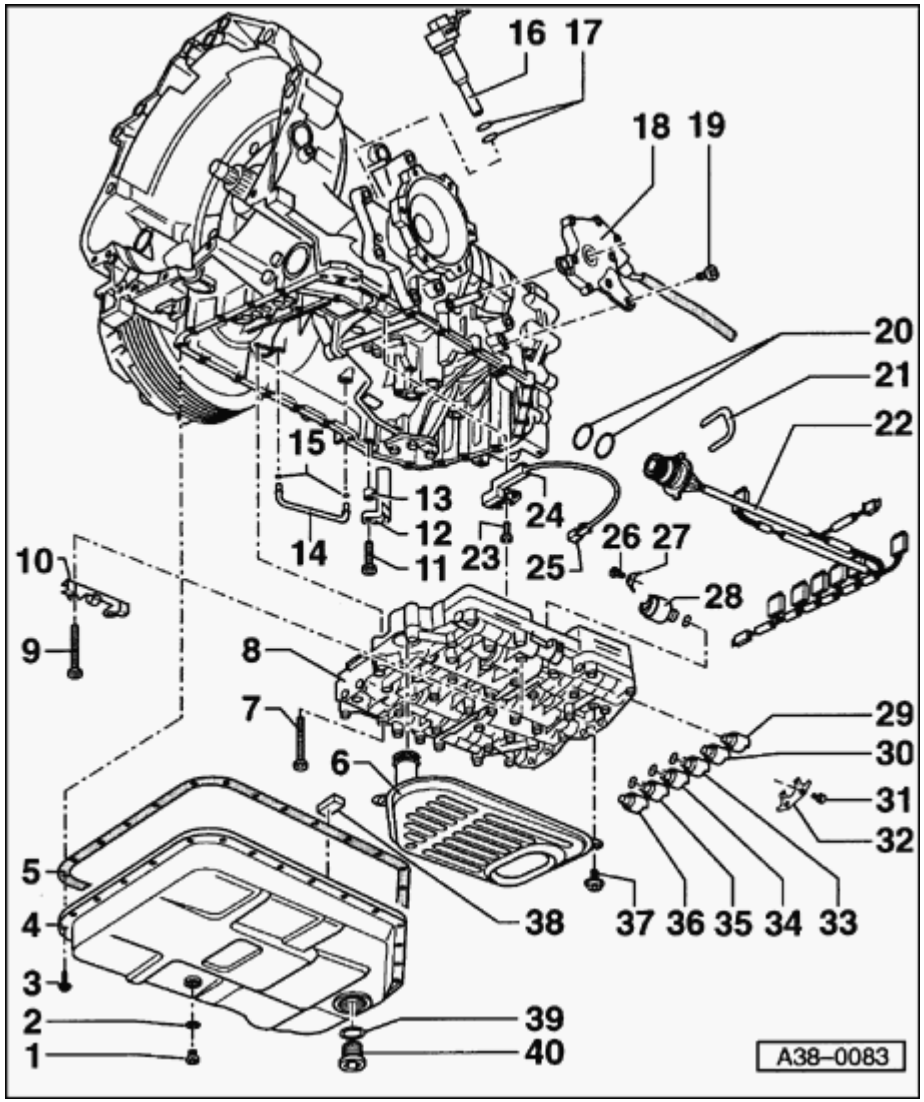
4 - Oil pan

- Removing and installing ⇒ page 38-19

5 - Gasket

- Always replace

38-12



6 - ATF-strainer

- Removing and installing ⇒ page 38-21

7 - Bolt - 8 Nm

- For mounting valve body: 1 bolt M6 x 30, 16 bolts M6 x 60
- Observe tightening sequence ⇒ page 38-26

8 - Valve body

- Removing and installing ⇒ page 38-22
- Allocation according to transmission code letters

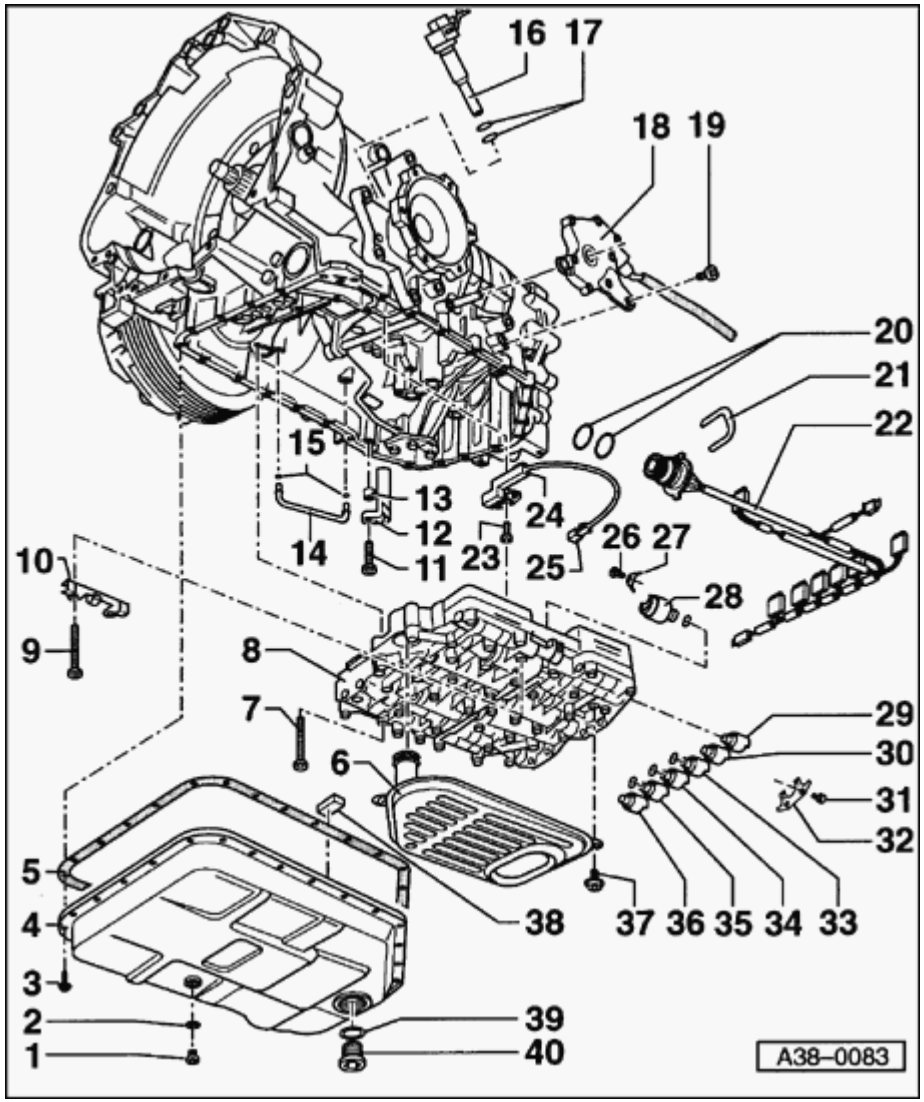
⇒ *Parts Catalog*

9 - Bolt - 8 Nm

10 - Bracket

- For wiring harness
- Hook in wiring harness
- Mounted with valve body bolts

38-13



11 - Bolt - 6 Nm

12 - Transmission Vehicle Speed Sensor (VSS) -G38-

- Removing and installing ⇒ page 38-40

13 - Spacer sleeve

- Height: 8 mm

14 - Inner oil line

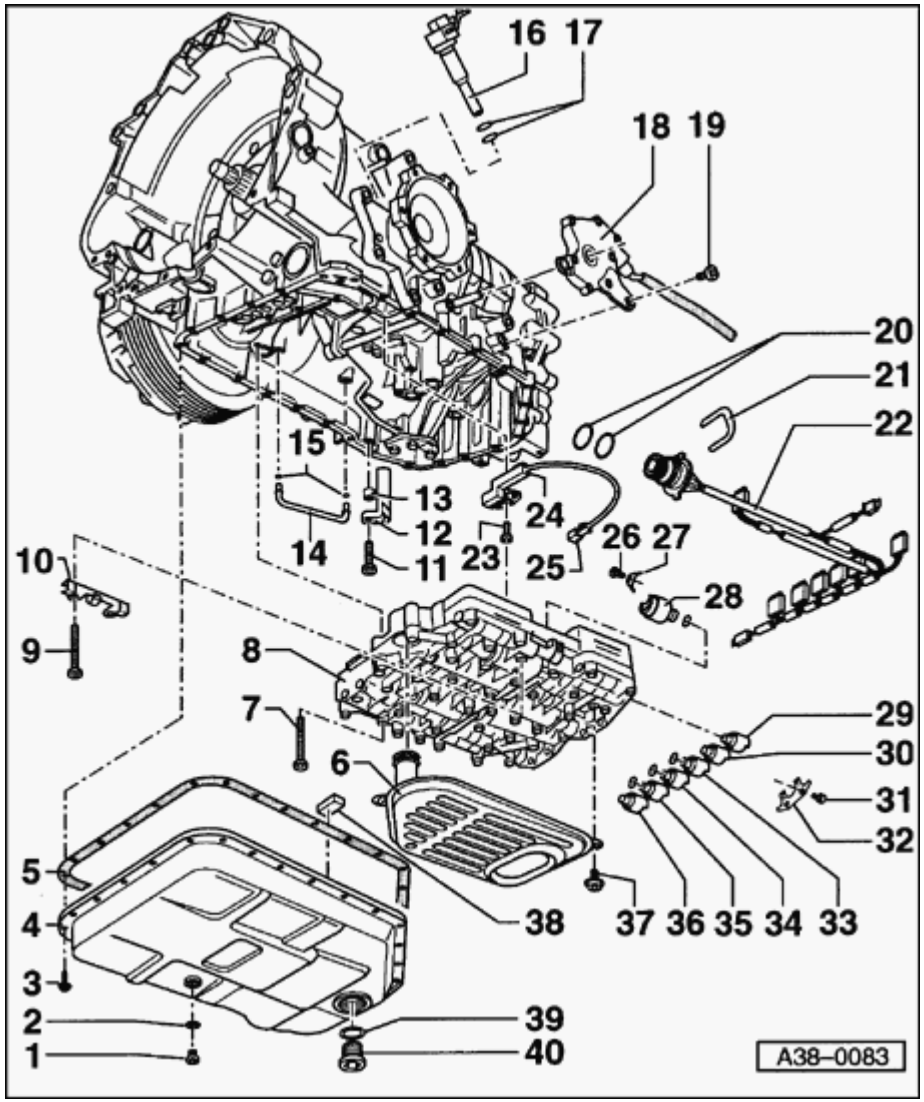
- Always replace
- Removing and installing ⇒ page 38-29

15 - O-ring

- Always replace

16 - Speedometer Vehicle Speed Sensor (VSS) -G22-

- Removing and installing ⇒ page 38-35



17 - O-ring

- Always replace
- Coat with Vaseline

18 - Multi-Function Transmission Range (TR) Switch -F125-

- Removing and installing ⇒ page 38-33
- Replacing shift rod sealing ring ⇒ page 38-31

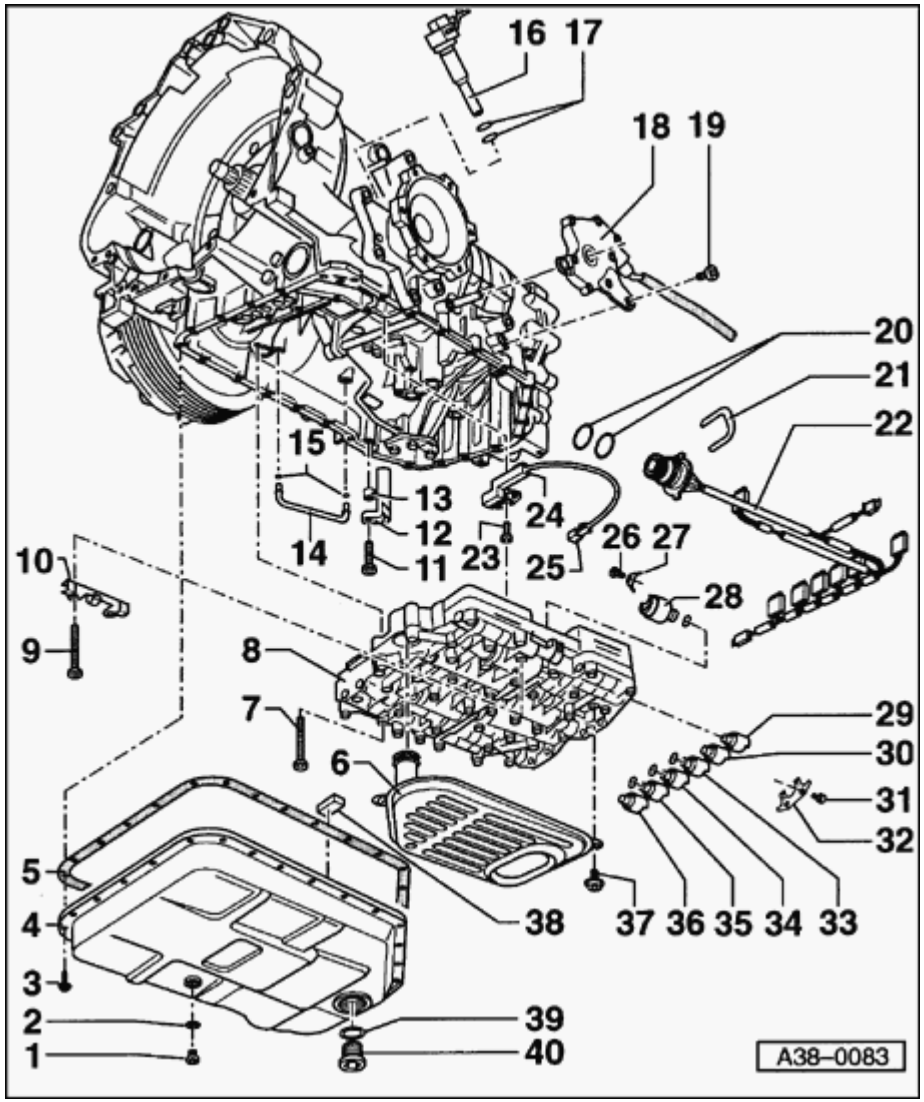
19 - Bolt - 8 Nm

20 - O-ring

- Always replace

21 - Locking clamp

38-15



22 - Wiring harness in transmission

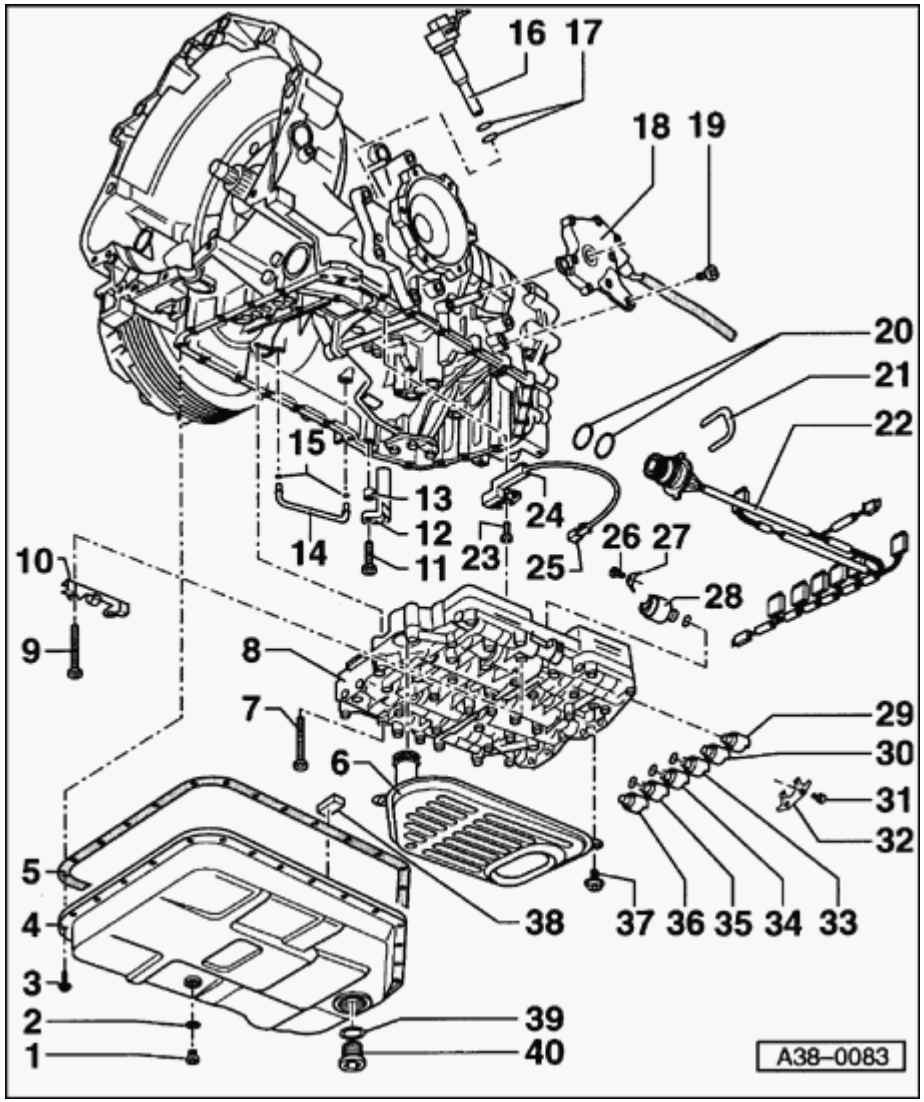
- Always replace ⇒ page 38-42
- Transmission Fluid Temperature Sensor - G93- is integrated into the wiring harness
- Remove and install valve body to replace ⇒ page 38-22
- Unhook from bracket for wiring harness, item 10
- Installation position wiring harness connector: Flat part of rear collar points toward oil pan, the tabs at collar are horizontal

23 - Bolt - 9 Nm

24 - Sensor for transmission RPM -G182-

- Removing and installing ⇒ page 38-36

38-16



25 - Connector

- Is connected at wiring harness in transmission
- Must be disconnected before removing the valve body

26 - Bolt - 6 Nm

27 - Bracket

- For solenoid valve

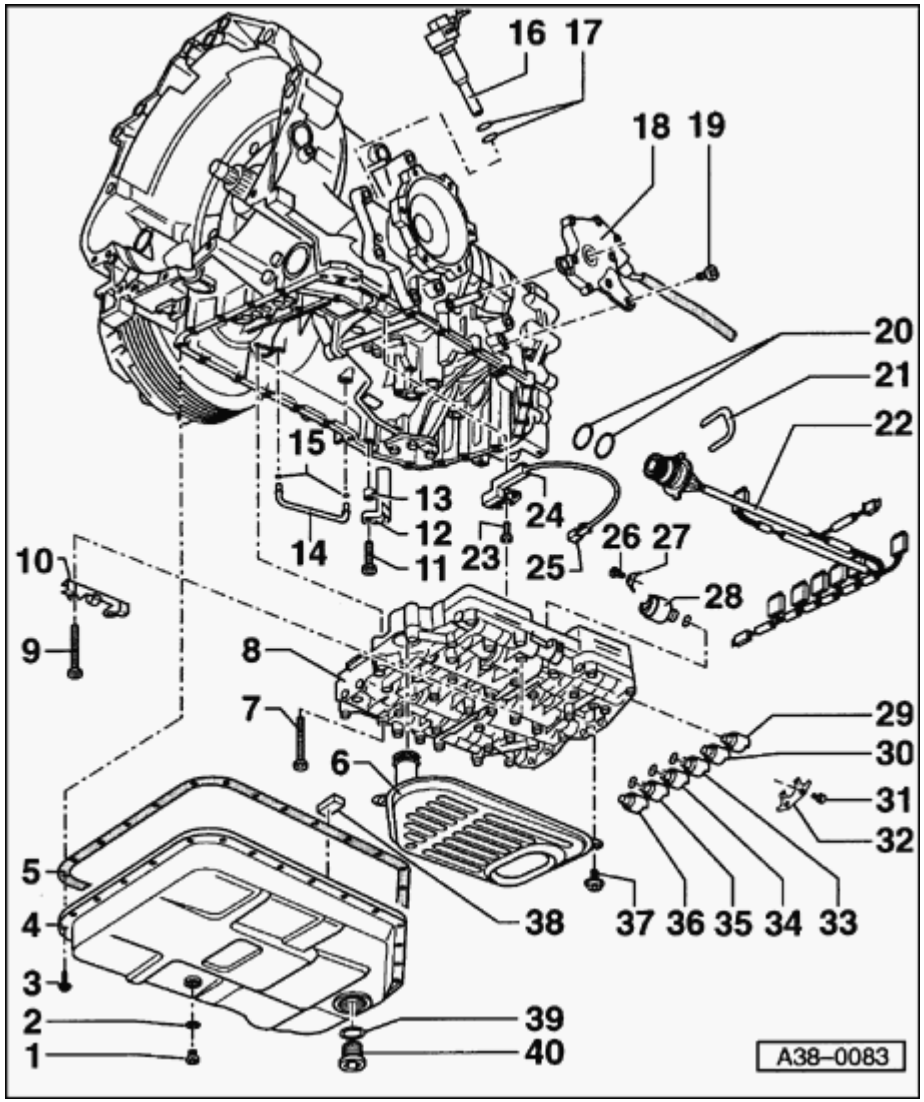
28 - Solenoid Valve 4 -N91-

- With O-ring
- Remove and install valve body to replace ⇒ page 38-22

29 - Solenoid valve 3 -N90-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19

38-17



30 - Solenoid valve 2 -N89-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19

31 - Bolt - 6 Nm

32 - Bracket

- For solenoid valves

33 - Solenoid Valve 6 -N93-

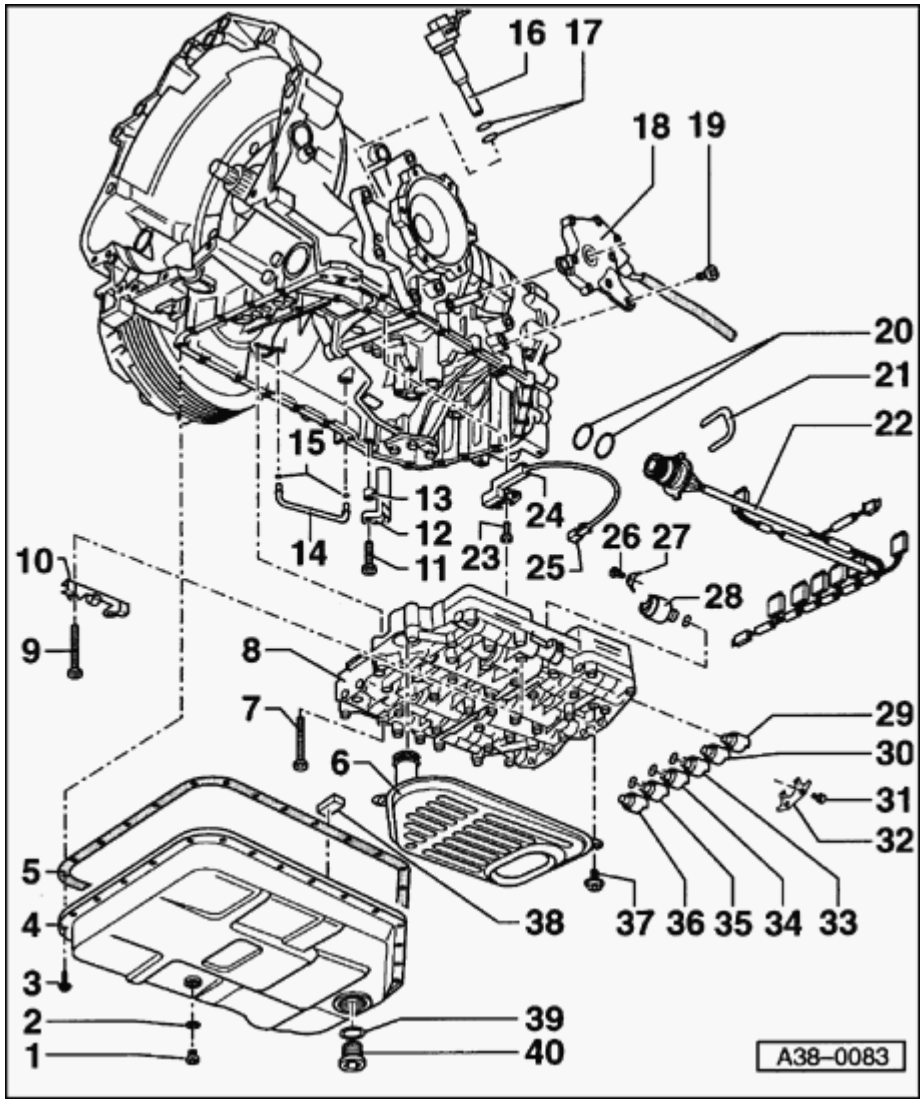
- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19

34 - Solenoid Valve 7 -N94-

- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19

35 - Solenoid valve 5 -N92-

- With O-ring
- Remove and install oil pan to replace ⇒ page 38-19



36 - Solenoid valve 1 -N88-

- Without O-ring
- Remove and install oil pan to replace ⇒ page 38-19 and unbolt guide plate for park locking mechanism
- When installing, do not tighten bolts for guide plate (23 Nm) in selector lever position "P".

37 - Bolt - 6 Nm

38 - Magnet

- 4 pieces in the oil pan recesses

39 - O-ring

- Always replace

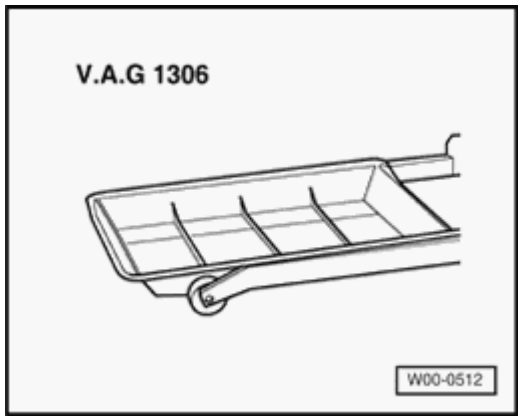
40 - ATF check plug - 80 Nm

- 17 mm socket-head bolt

38-19

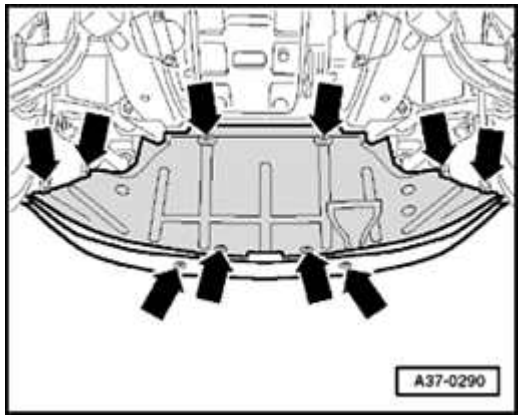
Oil pan, removing and installing

Special tools and equipment

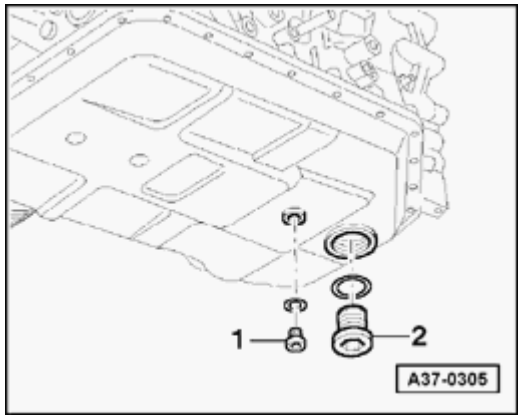


- VAG1306 drip tray

Removing



- Remove noise insulation panel (arrows).
- Place VAG1306 drip tray under transmission.



- Remove ATF drain plug -1- and drain ATF.
- Loosen bolts of oil pan in diagonal sequence.

Installing

Installation is reverse of removal, noting the following:

- Clean all 4 magnets in oil pan recesses. Ensure full surface contact of the magnets on the oil pan.
- Replace gaskets.

Note:

Drain plug and oil seal must both be replaced.

- Fill up ATF ⇒ page 37-140 .

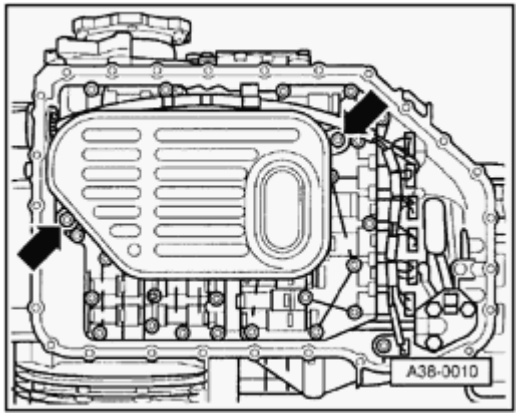
Tightening torques

Component	Nm
Drain plug to oil pan	40
Oil pan to transmission housing (diagonally in sequence)	 10

Oil strainer, removing and installing

Removing

- Removing oil pan ⇒ page 38-19 .



- Removing oil strainer bolts (arrows).
- Pull oil strainer off of valve body.

Installing

- Lightly coat seal on suction collar of oil strainer with ATF.
- Carefully press suction collar of oil strainer into the opening at valve body up to stop.
- Bolt on oil strainer.
- Installing oil pan ⇒ page 38-20 .
- Fill up ATF ⇒ page 37-140 .

Tightening torque

Component	Nm
Oil strainer to valve body	6

38-22

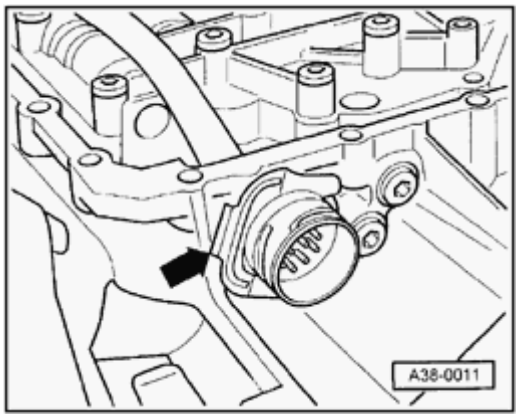
Valve body, removing and installing

Notes:

- *Always replace a soiled or faulty valve body.*
- *General repair notes* ⇒ *page 00-27* .
- *Rules of cleanliness for working on automatic transmissions* ⇒ *page 37-148* .

Removing

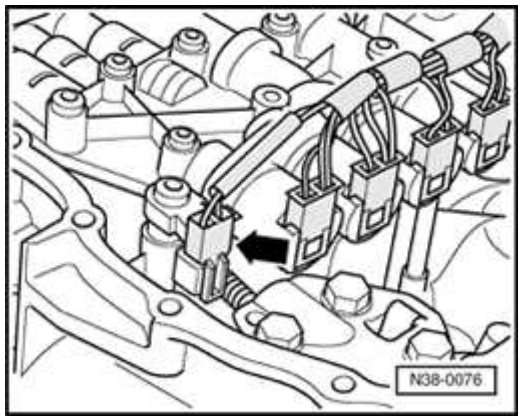
- Removing oil pan ⇒ page 38-19 .
- Removing oil strainer ⇒ page 38-21 .



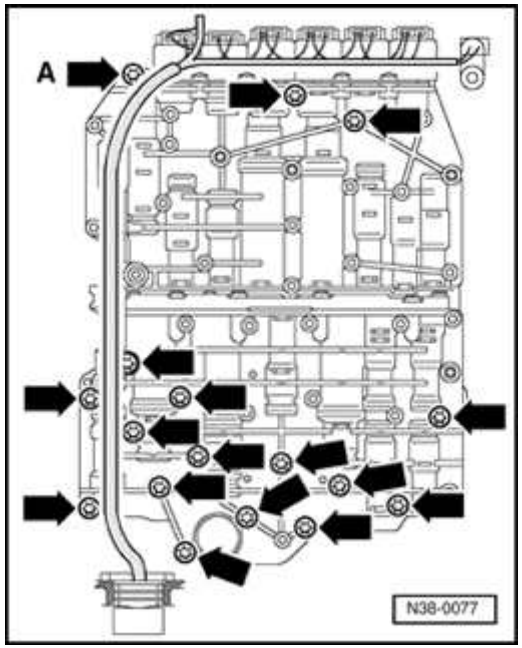
- Disconnect clip for wiring harness connectors (arrow).

38-23

Only for Park/Neutral Position (PNP) Switch - E17-



- Disconnect harness connector from Transmission Vehicle Speed Sensor (VSS) -G38- (arrow).



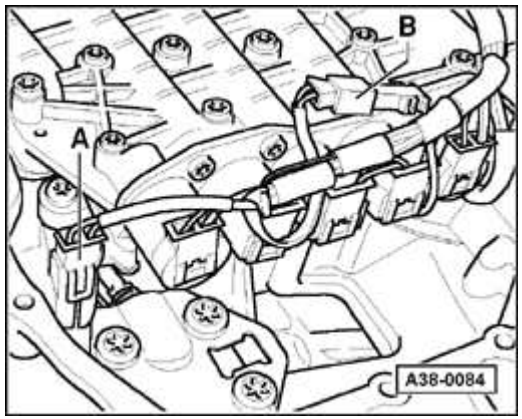
- Loosen mounting bolts (arrows) of valve body and remove valve body with wiring harness.

Notes:

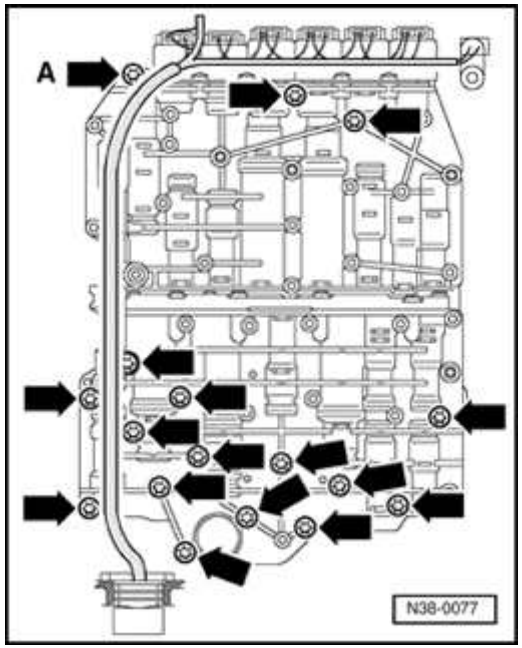
- *Only the marked mounting bolts (arrows) must be loosened.*
- *When loosening other bolts, the function of the valve body can be influenced or the valve body splits up.*
- *The bolt (arrow) A is shorter and thinner than the other bolts. Observe allocation.*

38-24

Only for transmission with hydraulic control E18/2



- Disconnect harness connector from Transmission Vehicle Speed Sensor (VSS) -G38- (-A-).
- Disconnect harness connector from Sensor for transmission RPM - G182- (-B-).



- Loosen mounting bolts (arrows) of valve body and remove valve body with wiring harness.

Notes:

- *Only the marked mounting bolts (arrows) must be loosened.*
- *When loosening other bolts, the function of the valve body can be influenced or the valve body splits up.*
- *The bolt (arrow A) is not installed on transmissions with hydraulic control E18/2 and can therefore be disregarded.*

All:

- Remove valve body from transmission while advancing the wiring harness connector.

Note only for Park/Neutral Position (PNP) Switch -E17-:

Do not place the removed valve body on the Sensor for transmission RPM at rear of valve body. Danger of damage.

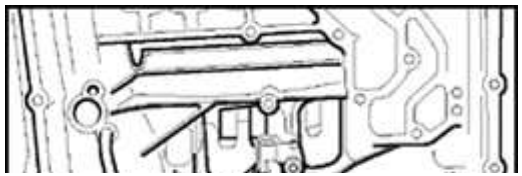
Installing

- Lightly coat O-rings of wiring harness connector with ATF.

- Insert wiring harness connector into transmission housing.

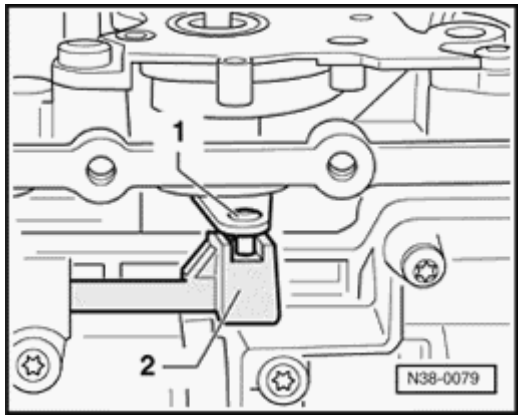
  - Installation position: Flat part of rear collar points downward, the tabs at collar are horizontal

Only for transmission with hydraulic control E18/2

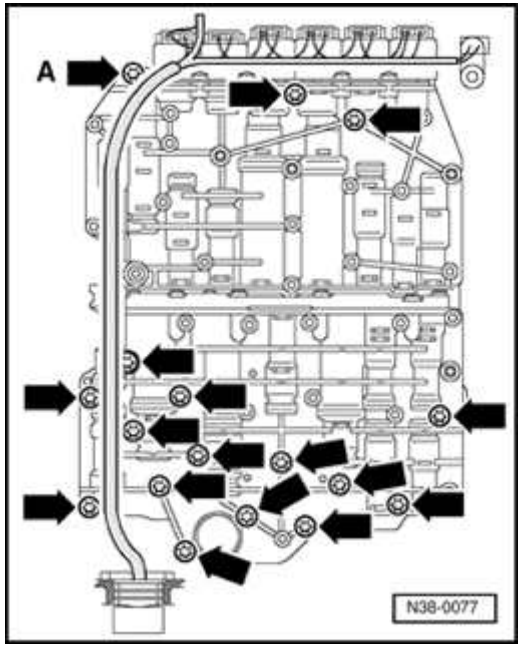


- Route wire with connector -C- according to illustration, so that the wire is not pinched when installing the valve body.

All:



- Set valve body in place without force while placing bolt of notched disc -1- into the groove of the selector register -2-.



- Next, tighten valve body bolts (arrows) by hand.

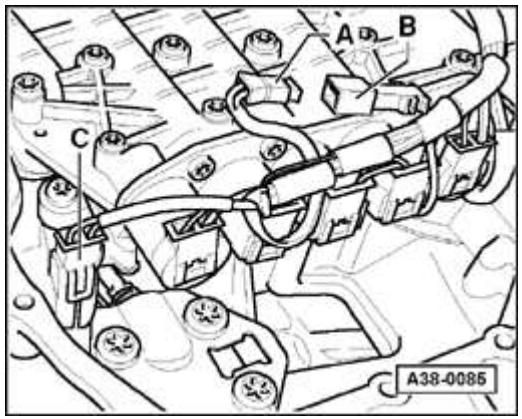
Notes:

On transmissions with Park/Neutral Position (PNP) Switch -E17-, the bolt (arrow A) is shorter and thinner than the other bolts. Observe allocation.

The bolt (arrow A) is not installed on transmissions with hydraulic control E18/2 and can therefore be disregarded.

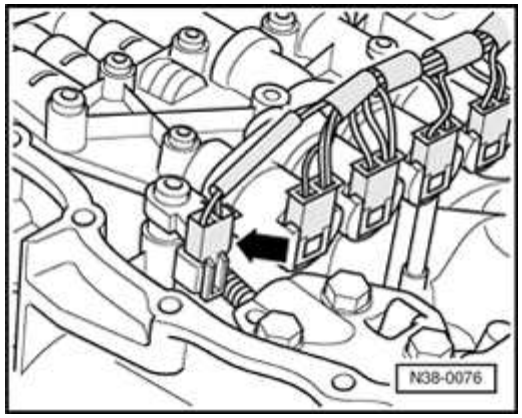
- Then tighten valve body bolts from inside out to final tension.

Only for transmission with hydraulic control E18/2



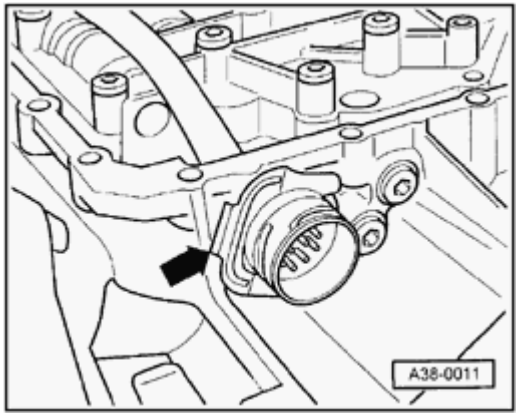
- Pull wiring with connector -B- of Sensor for transmission RPM -G182- between valve body and wiring harness upward.
- Connect connector -B- to connector -A- at wiring harness.
- Connect connector -C- to Transmission Vehicle Speed Sensor (VSS) -G38-.

Only for Park/Neutral Position (PNP) Switch -E17-



- Connect connector (arrow) to Transmission Vehicle Speed Sensor (VSS) -G38-.

38-28



All:

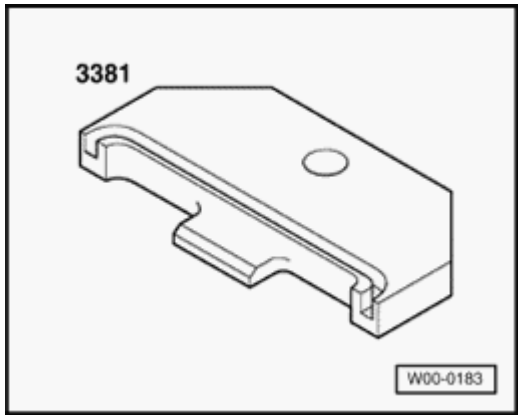
- Connect clip to wiring harness connector (arrow).
- Installing oil strainer ⇒ page 38-21 .
- Installing oil pan ⇒ page 38-20 .
- Fill up ATF ⇒ page 37-140 .

Tightening torque

Component	Nm
Valve body to transmission housing (from inside out)	8

Oil line inside transmission, removing and installing

Special tools and equipment



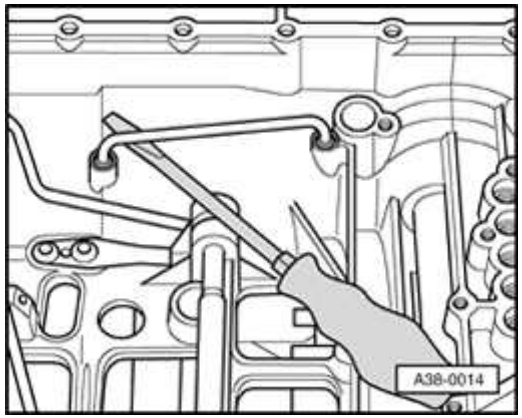
- 3381oil line installer

Notes:

- *Faulty O-rings at inner oil line allow ATF to enter the differential, which becomes over-filled and oil escapes at differential vent.*
- *A removed oil line generally must be replaced.*
- *The oil line must only be inserted using 3381oil line installer. Otherwise there is a risk of leaks because of bending of the oil line.*

Removing

- Removing valve body ⇒ page 38-22 .

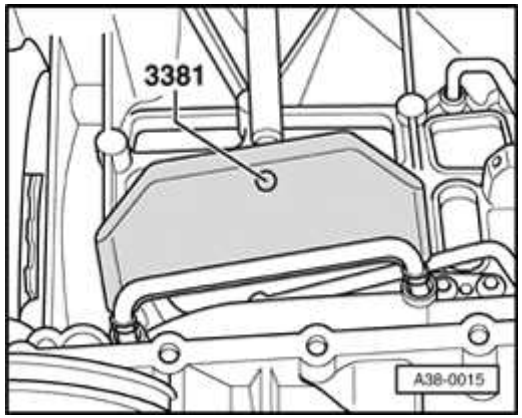


- Lever off inner oil line evenly from transmission housing.

Installing

Installation is reverse of removal, noting the following:

- Replace O-rings.



- Insert oil line into 3381 oil line installer.
- Drive oil line into transmission housing by lightly tapping on the 3381 oil line installer up to stop using a plastic mallet.

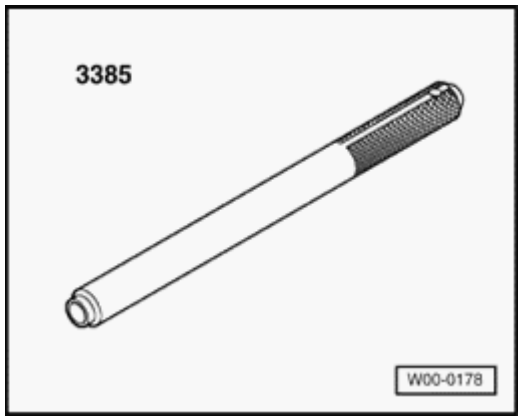
Notes:

- *The open side of 3381 oil line installer faces toward the outer wall of the transmission.*
- *Do not cant oil line. Drive in both line ends uniformly.*

- Installing valve body ⇒ page 38-25 .
- Fill up ATF ⇒ page 37-140 .
- Checking oil level in front final drive ⇒ page 39-1 .

Shift rod seal, replacing

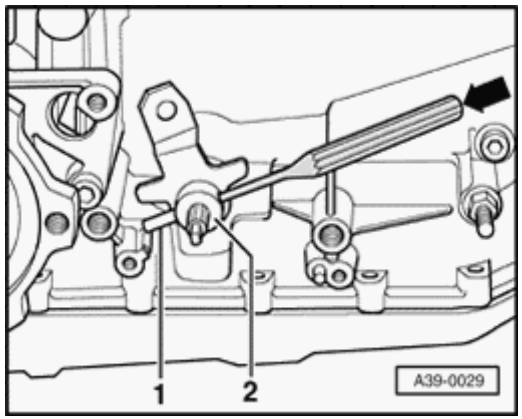
Special tools and equipment



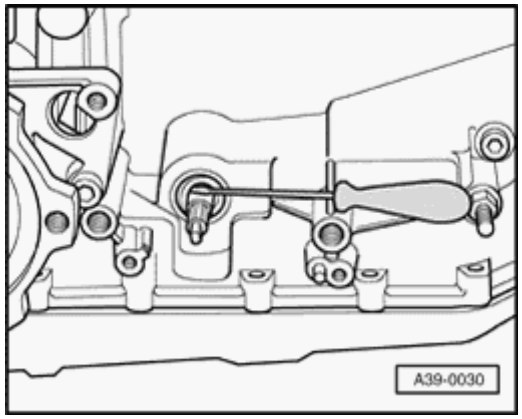
- 3385 sealing ring installer

Removing

- Removing left transmission support ⇒ page 37-125 .
- Removing Multi-Function Transmission Range (TR) Switch -F125- ⇒ page 38-33 .



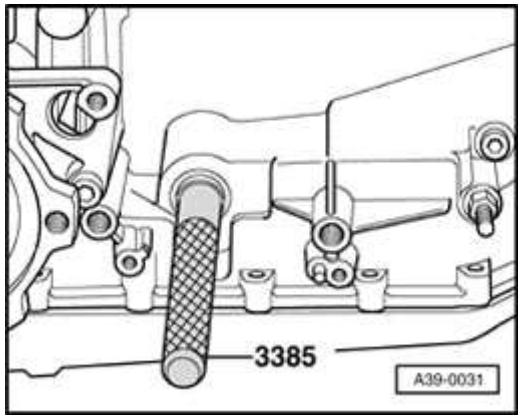
- Drive out spring dowel sleeve -1- at lever/shift rod -2- in direction of travel toward the front (arrow), until the lever/shift rod can be pulled off the shift rod.



- Pierce sealing ring using a small screwdriver and pull out.

Installing

- Coat outer circumference and gap between sealing lips with ATF.
  - Installation position: The open side of the sealing ring faces the transmission.



- Slide new sealing ring onto 3385 sealing ring installer without canting and drive in up to stop of pressure piece.
- Installing Multi-function switch ⇒ page 38-33 .
- Drive back spring dowel sleeve with transmission not yet removed in opposite direction through the lever.
- Slide transmission shift lever onto shift rod and drive in spring dowel sleeve.
- Installing left transmission support ⇒ page 37-125 .

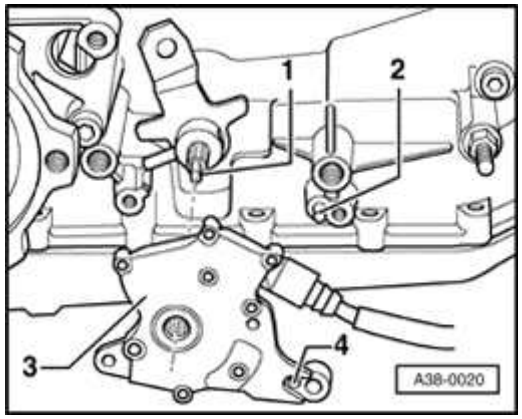
Multi-Function Transmission Range (TR) Switch -F125-, removing and installing

Removing

- Removing left transmission support ⇒ page 37-125 .

- Unbolt Multi-Function Transmission Range (TR) Switch -F125- from transmission and pull off from shift rod.

Installing

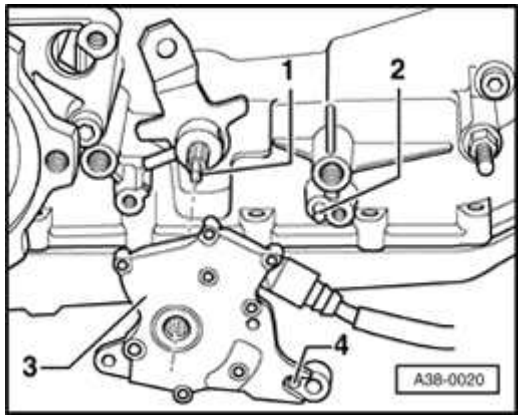


- Connect Multi-Function Transmission Range (TR) Switch -F125- on shift rod. Flap part at splines in switch -3- must align with flat part of shift rod -1-.

Note:

Set Multi-Function Transmission Range (TR) Switch -F125- onto shift rod in centered manner. Do not cant and do not set with force. Risk of damage at switch terminals.

38-34



- Rotate switch until the alignment hole -4- at switch housing can be fitted on the alignment pin -2- at transmission housing.
- Installing left transmission support ⇒ page 37-125 .

Tightening torques

Component	Nm
multi-function Transmission Range (TR) switch -F125- to transmission	8

38-35

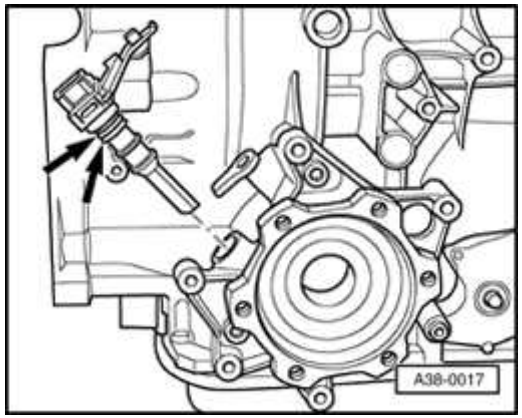
Speedometer Vehicle Speed Sensor (VSS) -G22-, removing and installing

Removing

- Disconnect harness connector from Speedometer Vehicle Speed Sensor (VSS) -G22-.

- Push retaining bracket of sensor downward, turn and pull sensor out.

Installing



- Replace sealing rings (arrows).
- Insert O-rings with grease.
- Insert sensor.
- Engage retaining bracket at mounting bracket for flange shaft.

38-36

Sensor for transmission RPM -G182-, removing and installing

Note:

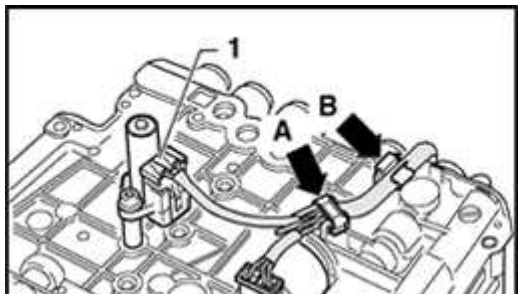
- *There is a distinction made between two types of transmission. Transmissions with hydraulic control E17, the sensor for transmission RPM (inductive sensor) is secured to bottom of valve body. Transmissions with hydraulic control E18/2, the sensor for transmission RPM (hall effect sensor) is secured to transmission housing behind valve body.*

- *Information regarding which transmission is installed can be found in tables ⇒ page 00-4 onward.*

For transmissions with hydraulic control E17

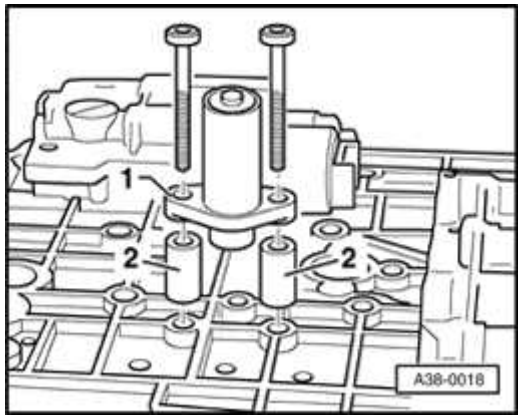
Removing

- Removing valve body ⇒ page 38-22 .



- Turn valve body on its back side and loosen connector at Sensor for transmission RPM -1-.

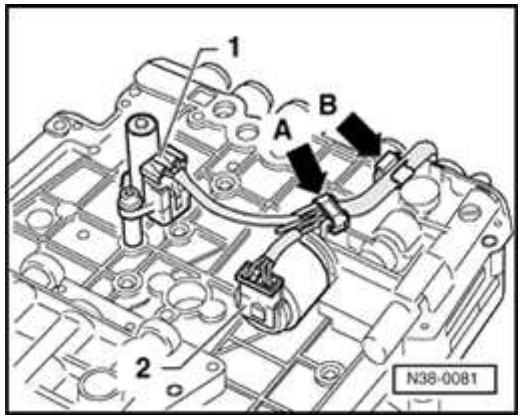
38-37



- Unbolt Sensor for transmission RPM -1- at valve body.

Installing

- Tighten Sensor for transmission RPM -1- using spacer sleeves -2- (height: 20 mm) to 7 Nm.
  - Installation position: Sensor-side with the connector terminals points to valve body center.



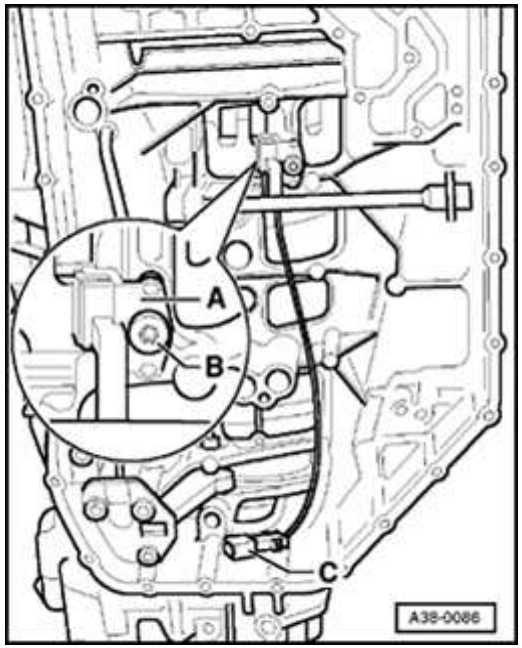
- Connect connector to Sensor for transmission RPM -1-.
- Installing valve body ⇒ page 38-25 .
- Fill up ATF ⇒ page 37-140 .

38-38

For transmissions with hydraulic control
E18/2

Removing

- Removing valve body ⇒ page 38-22 .

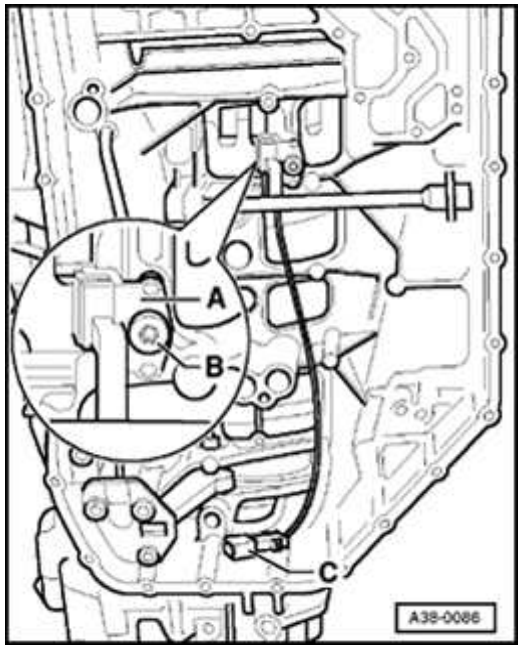


- Unbolt Sensor for transmission RPM -A- from transmission.

Installing

- Bolt on Sensor for transmission RPM -A- at transmission via bolt -B-. Tightening torque is 9 Nm.

38-39



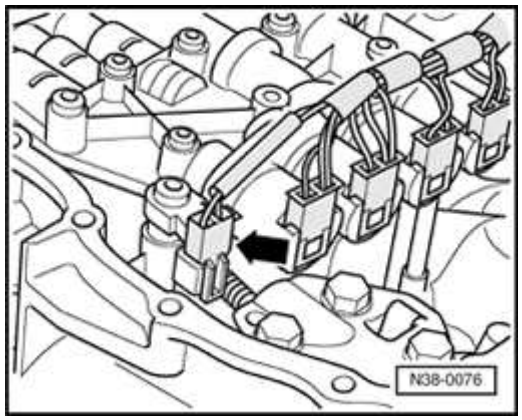
- Route wire with connector -C- according to illustration, so that the wire is not pinched when installing the valve body.
- Installing valve body ⇒ page 38-25 .
- Fill up ATF ⇒ page 37-140 .

38-40

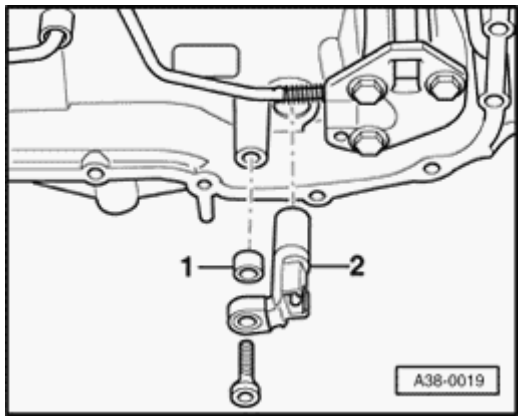
Transmission Vehicle Speed Sensor (VSS) -G38-, removing and installing

Removing

- Removing oil pan ⇒ page 38-19 .



- Disconnect harness connector from Transmission Vehicle Speed Sensor (VSS) -G38- (arrow).

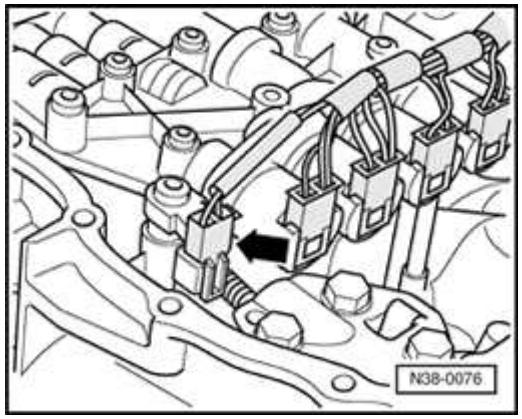


- Remove Transmission Vehicle Speed Sensor (VSS) -2-.

Installing

- Install and tighten Transmission Vehicle Speed Sensor (VSS) -2- using spacer sleeve -1- (height: 8 mm) to 6 Nm.

38-41



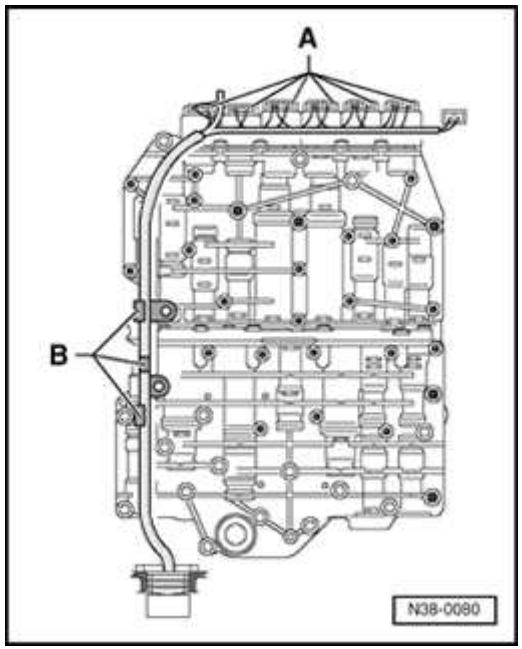
- Connect connector at Transmission Vehicle Speed Sensor (VSS) - G38-.
- Installing oil pan ⇒ page 38-20 .
- Fill up ATF ⇒ page 37-140 .

38-42

Wiring harness in transmission, removing and installing

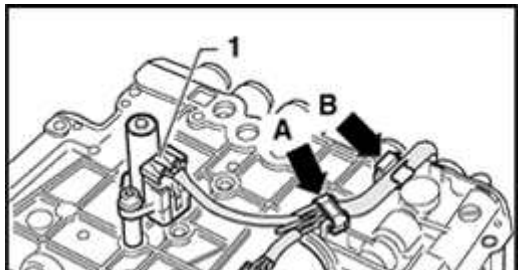
Removing

- Removing valve body ⇒ page 38-22 .



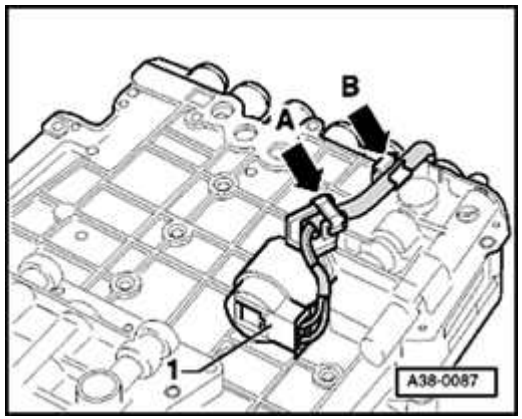
- Lever out retainer straps of connectors at solenoid valves using a small screwdriver and disconnect connectors -A- in sequence.
- Unhook wiring harness at side retainer straps -B- of valve body.

Only for Park/Neutral Position (PNP) Switch -E17-



- Turn valve body on its back side and loosen connector at Sensor for transmission RPM -1-.
- Remove retaining clip (arrow A) and unclip wiring harness from retaining clip (arrow B).
- Disconnect connector -2- from Solenoid Valve 4 -N91-.

38-43



Only for transmission with hydraulic control E18/2

- Turn valve body on its back side and loosen connector at Sensor for transmission RPM -1-.
- Remove retaining clip (arrow A) and unclip wiring harness from retaining clip (arrow B).

Installing, valid for all:

Installation is reverse of removal, noting the following:

- When installing, connect connectors of wiring harness to the corresponding solenoid valves.
- Clip wiring harness into the respective retaining clips. In case of deviations, the wiring harness can be pinched during installation of the valve body.
- Installing valve body ⇒ page 38-25 .
- Fill up ATF ⇒ page 37-140 .

Transmission Fluid Temperature Sensor -G93-, replacing

Note:

Transmission Fluid Temperature Sensor -G93- is integrated in the transmission wiring harness.

Removing

- Remove wiring harness in transmission ⇒ page 38-42 .

Installing

Installation is the reverse of removal. Also carry out the following procedure.

- Replace wiring harness with a new one.

39-1

Drive flange seal, replacing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-10 .

Special tools and equipment

- VW195 arbor
- VW295 needle bearing drift
- VW681 extractor lever
- VAG1306 drip tray

Notes:

- *The following illustration shows removal and installation of the left seal.*
- *The same procedure is used for the left and right seals.*
- *The exhaust system need not be removed.*

- *Flanges with and without polygon bearings are used. Application ⇒ Page 00-3 .*

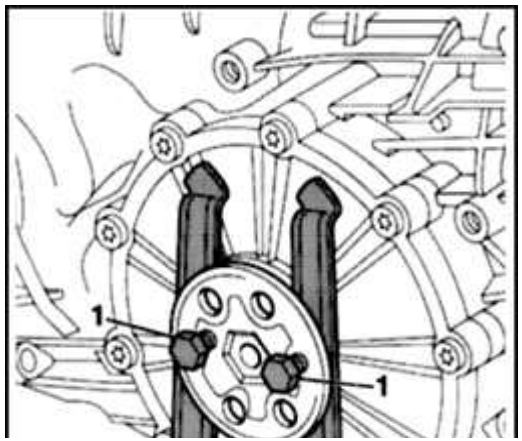
39-2

Removing

- Remove heat shield for drive axle.
- Remove drive axle from transmission drive flange.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

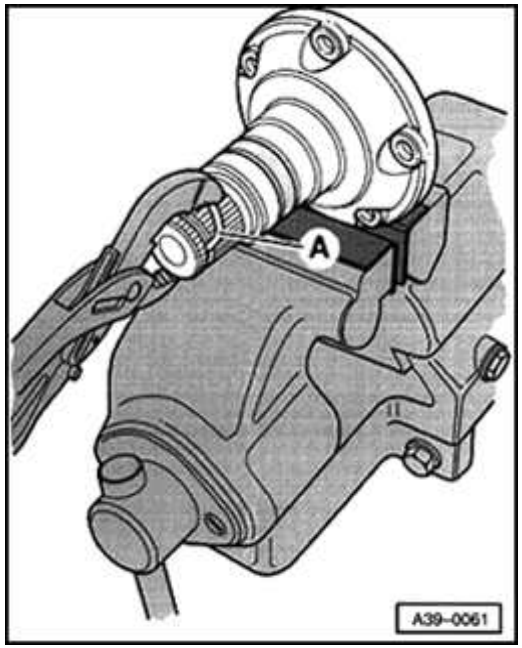
- Turn steering as far to left as possible.
- Tie up drive axle as high as possible. Do not damage paint on drive axle.
- Place VAG1306 drip tray under transmission.



- Have second technician hold two tire irons -2- under drive flange.
- To remove drive flange, install two bolts -1- evenly into two opposite bores in drive flange.

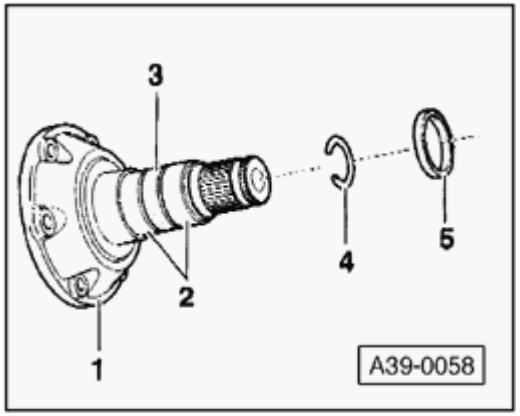
Note:

The drive flange must be removed evenly and parallel. If pressure is only applied to one side, the differential may break.



- Always replace circlip for drive flange.
- Clamp drive flange into vise using protective jaws. Press circlip out of groove in drive flange by pressing in new circlip -A-.
- Remove drive flange seal using VW681 extractor lever.

39-4



Setup of drive flange with polygon bearing

1 - Drive flange

2 - Needle bearing (polygon bearing)

3 - Spacer ring

4 - Circlip

5 - Spacer ring (is installed additionally if spline diameter is 30 mm)

Notes:

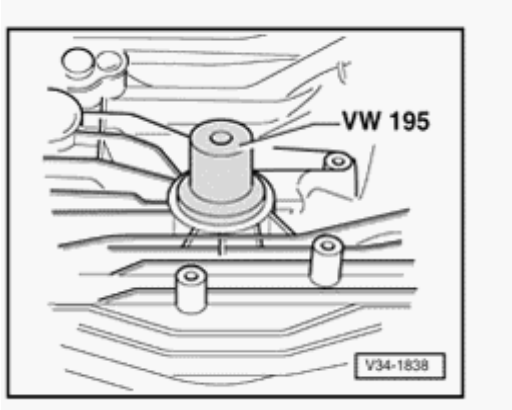
- *The rough operation of the polygon bearing with the drive flange not installed is not an indication that the bearings are malfunctioning. An acoustic check can only be carried out while installed.*
- *Watch for damage to the polygon bearings (e.g. cracks in bearing outer ring).*
- *Polygon bearings can only be replaced together with drive flange.*
- *A spacer ring -5- is installed between the polygon bearing and differential pinion for drive flanges with a spline diameter of 30 mm (1.2 in.).*

39-5

Installing

- Lubricate area between sealing lip and dust lip with a thin layer of multi-purpose grease.

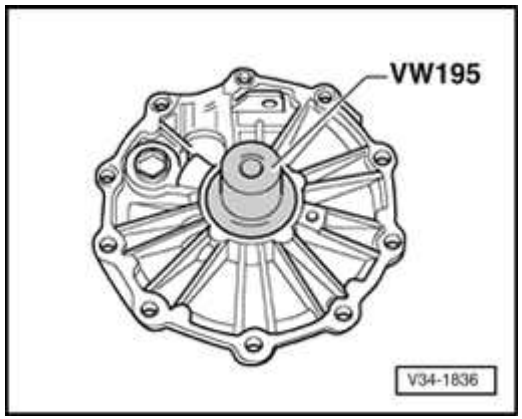
- Lightly oil outer circumference of seal.



- Drive in new right-hand drive flange seal 5.5 mm (0.217 in.) below transmission housing surface, without canting.

Note:

If reinstalling an old drive flange, the seal must be pressed in approximately 6.5 mm (0.256 in.) so that the new seal does not sit on the running surface of the old seal.



- Drive in new left-hand drive flange seal 5.5 mm (0.217 in.) below transmission cover surface, using VW195 arbor, without canting.

Note:

If reinstalling an old drive flange, the seal must be pressed in approximately 6.5 mm (0.256 in.) so that the new seal does not sit on the running surface of the old seal.

- Drive in drive flange using VW295 needle bearing drift.
- Bolt drive axle to drive flange.

- Install heat shield for drive axle.

- Check transmission oil level ⇒ Page 34-36 .

Tightening torques

Component		Tightening torque
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Heat shield for drive axle		23 Nm (17 ft lb)

39-1

Drive flange seal, replacing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

Special tools and equipment

- VW195 arbor
- VW295 needle bearing drift
- VW681 extractor lever
- VAG1306 drip tray

Notes:

- *Removal and installation of the left seal is shown in the following illustration.*
- *The procedure for left and right seal is the same.*
- *The exhaust system does not need to be removed.*

- *Transmission code CXF: drive flanges are installed without polygon bearings.*

- *For drive flanges with a gear diameter of 30 mm (1.181 in.) a spacer ring is installed between the polygon bearing and the tapered bearing ⇒ Page 39-4 .*

39-2

Removing

- Remove heat shield for drive axle.

- Remove drive axle from transmission drive flange.

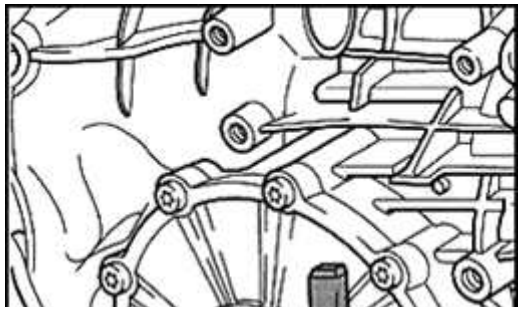
⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40.*

- Turn steering as far to left as possible.

- Tie-up drive axle as high as possible. Do not damage paint on drive axle.

- Place VAG1306 drip tray underneath transmission.

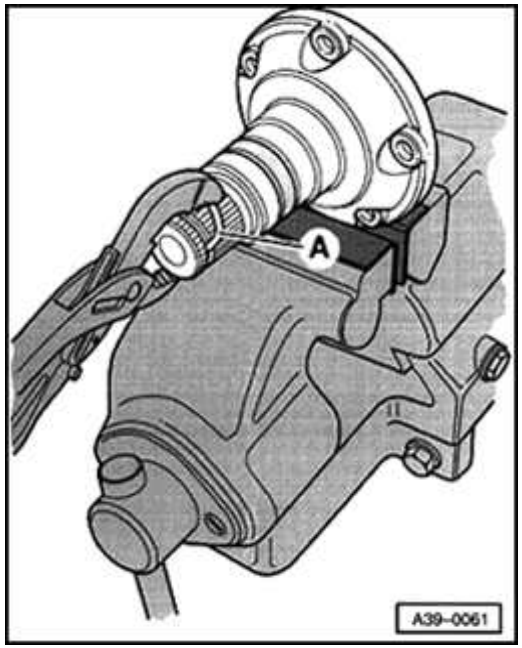
- Place chisel or spacer -A- under drive flange.



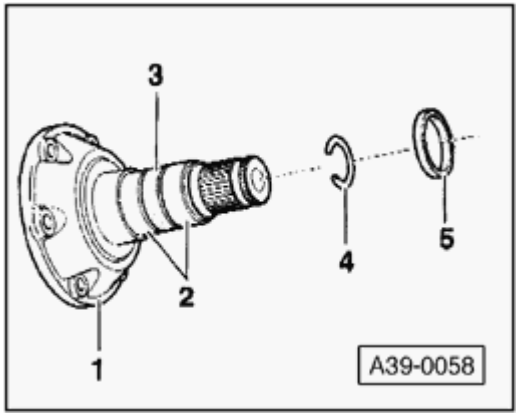
- Turn bolt -B- to pull drive flange out of differential bevel gears.

Note:

If the drive flange does not come out easily, turn the drive flange and insert a bolt in the hole on the opposite side to assist removal.



- Always replace circlip for drive flange.
- Clamp drive flange in vise using protective jaws and remove circlip by pressing new circlip -A- into groove.
- Remove drive flange seal using VW681 extractor lever.



Setup of drive flange with polygon bearing

1 - Drive flange

2 - Needle bearing (Polygon bearing)

3 - Spacer ring

4 - Circlip

5 - Spacer ring (is installed additionally if spline diameter is 30 mm or 1.181 in.)

Notes:

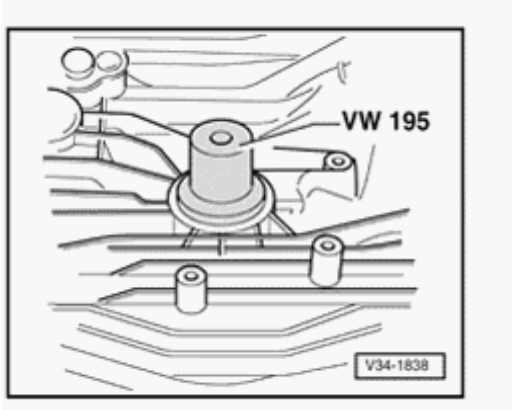
- The rough surface of the polygon bearings with the drive flange not installed is not an indication that the bearings are malfunctioning. An acoustic check can only be carried out while installed.
- Watch for damage to the polygon bearings (e.g. cracks in bearing outer rings).
- Polygon bearings can only be replaced together with the drive flanges.
- For drive flanges with a spline diameter of 30 mm (1.181 in.) a spacer ring -5- is installed between the polygon bearing and the tapered bearing.

39-5

Installing

- Fill space between sealing lip and dust lip with gear oil.

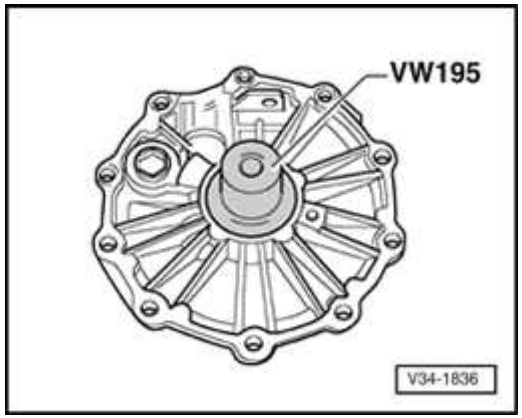
- Lightly oil outer circumference of seal.



- Drive in right-hand drive flange seal 5.5 mm (0.216 in.) below outer transmission housing surface using VW195 arbor, without canting.

Note:

If reinstalling an old drive flange, the new seal must be pressed in about 6.5 mm (0.256 in.), so that the new seal does not sit on the running surface of the old seal.



- Drive in left drive flange seal 5.5 mm (0.216 in.) below outer transmission housing surface using VW195, without canting.

Note:

If reinstalling an old drive flange, the new seal must be pressed in about 6.5 mm (0.256 in.), so that the new seal does not sit on the running surface of the old seal.

- Install drive flange using VW295 needle bearing drift.
- Bolt drive axle on drive flange.

- Install drive axle heat shield.

- Check transmission oil level ⇒ Page 34-38 .

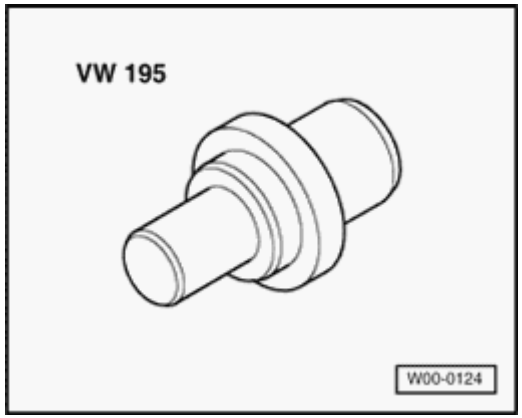
Tightening torques

Component		Nm (ft lb)
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)
Heat shields for drive axles		23 Nm (17 ft lb)

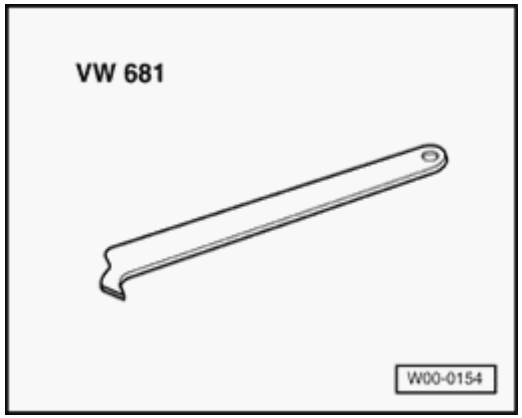
39-1

Drive flange seal, replacing

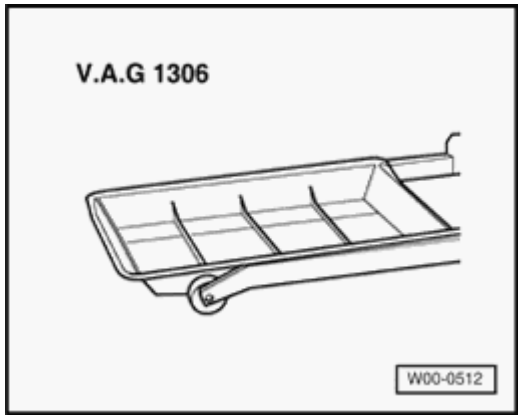
Special tools, testers and auxiliary items required:



- Arbor VW 195



- Extractor lever VW 681



- Drip tray V.A.G 1306

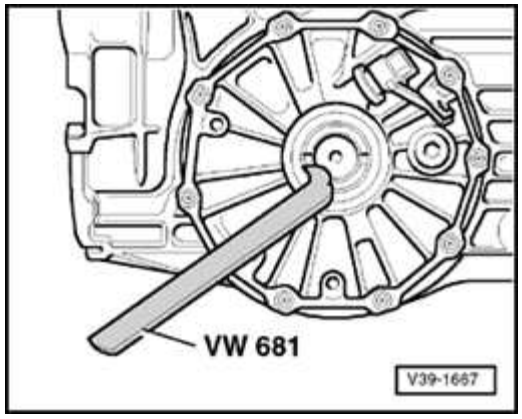
Removing

- Transmission installed

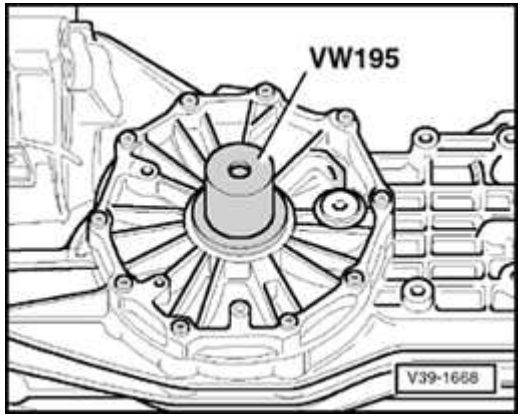
Note:

- *Illustrated, removing and installing oil seal on left-hand side.*
- *Procedure for removing oil seal on left and right-hand sides is identical.*

- Remove heat shield.
- Disconnect drive axle.
- Place a drip tray underneath.
- Remove drive flange, secure with a drift to prevent it turning.



- Pull seal out with lever VW 681.



Installing

- Fill space between sealing and dust lips with sealing grease G52 128 A1.

- Lightly oil outer circumference of seal.

- Drive in seal for drive flange.
  - Pressing-in depth (factory): 5.5 mm
  - Pressing-in depth when re-installing a used drive flange (repairs): 6.5 mm
- Install drive flange and drive axle.

Tightening torques

Component	Nm
Drive flange to transmission	10 + 90° 1)
Drive axle to drive flange M10	80
Heat shield for drive axle	25

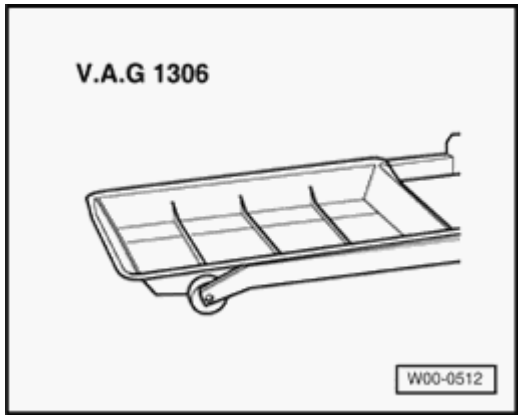
1) 90° equals to a quarter turn

39-1

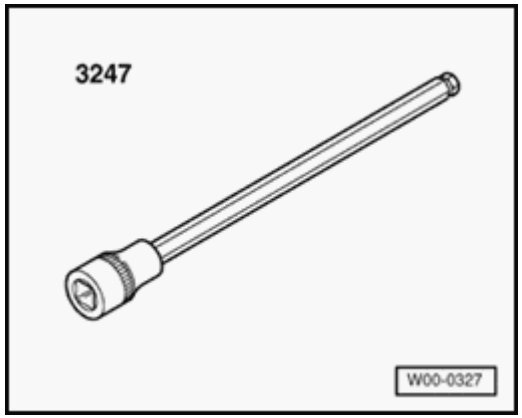
Gear oil in front final drive

Gear oil in front final drive, checking

Special tools and equipment

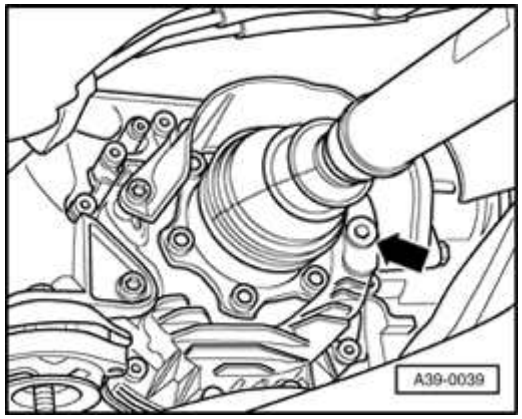


- VAG1306 drip tray



- 3247 plug insert (8mm)

- Perform a short road test to heat up gear oil to approx. 60 ° C.
- Drive the vehicle onto a 4-column lift or over a work pit so that it is absolutely level.
- Switch engine off and let gear oil drip out for 5 minutes.
- Place VAG1306 drip tray underneath.



- Remove oil filler plug (arrow).

Note:

Loosen locking bolt using an angled socket-head wrench, but do not use 3247 hex ball socket. For improved accessibility it may be necessary to remove the heat shield and drive axle and to set them aside.

If 3247 hex ball socket is used for loosening the bolt, it could be destroyed.

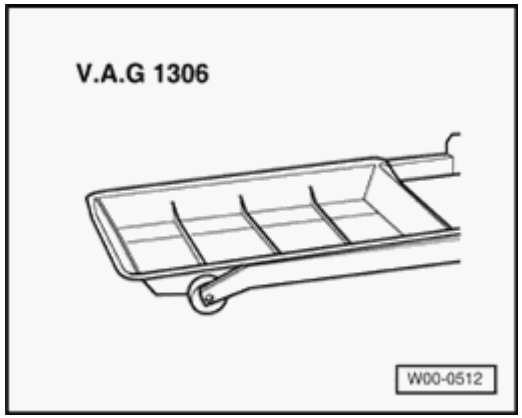
  - ♦ Specification: Oil level should reach lower edge of oil filler hole.

- Let excessive gear oil drain or top up gear oil.
  - ♦ Specification ⇒ page 00-22
- Always replace O-ring for oil filler plug.
- Tighten locking bolt using 3247 hex ball socket (8mm socket) to 30 Nm.

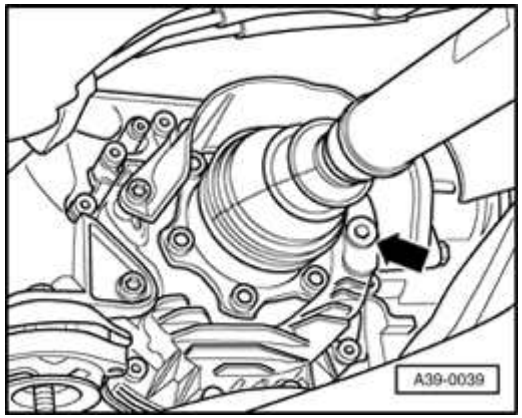
39-3

Gear oil in front final drive, filling up after repair

Special tools and equipment



- ♦ VAG1306 drip tray
- Drive the vehicle onto a 4-column lift or over a work pit so that it is absolutely level.
- Place VAG1306 drip tray underneath.



- Remove oil filler plug (arrow).

Note:

Loosen locking bolt using an angled socket-head wrench, but do not use 3247 hex ball socket. For improved accessibility it may be necessary to remove the heat shield and drive axle and to set them aside.

If 3247 hex ball socket is used for loosening the bolt, it could be destroyed.

- Slowly and uniformly fill front final drive over a time period of at least 5 minutes until gear oil escapes at lower edge of oil filler hole.

  - Specification ⇒ page 00-22

Note:

Filling time of at least 5 minutes is essential, so that the internal oil level compensation between differential and retaining area can occur.

- Install old oil filler plug.

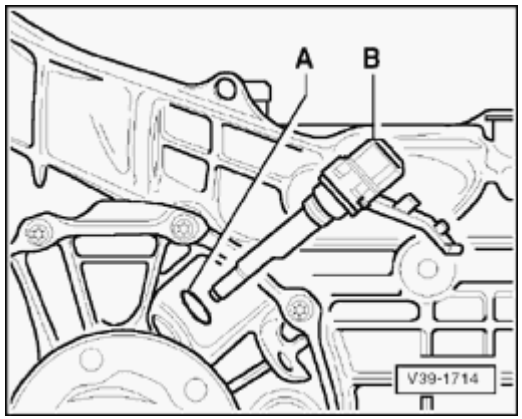
- Perform a short road test to heat up gear oil to approx. 60 ° C.

- Make sure to check oil level in front final drive ⇒ page 39-1 !

Speedometer sender -G22- and drive wheel for speedometer sender, removing and installing

- Transmission installed

Removing and installing speedometer sender -G22-

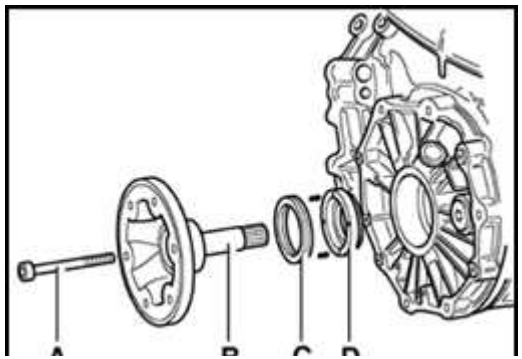


- Pull connector off sender -B-.
- Press sender retainer down, turn and pull out sender.
- Replace O-ring -A-.

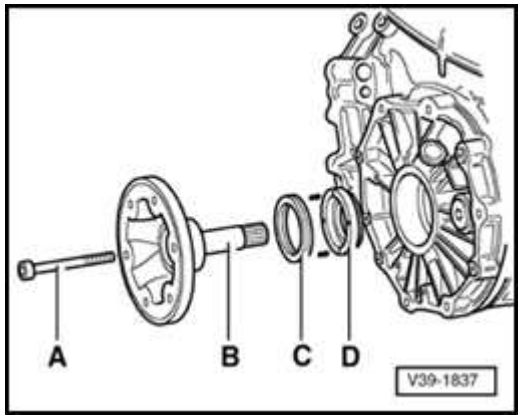
Removing and installing drive wheel for speedometer sender -G22-

Removing:

- Detach drive axle from left drive flange -B-.



- Unscrew bolt -A-. Secure drive flange with a drift to prevent it turning.
- Remove drive flange and seal -C-.



- Using a screwdriver, pry out drive wheel for speedometer sender -D- on alternate sides at the follower lugs (arrows).

Installing:

- Install drive wheel for speedometer sender so that follower lugs (arrows) face toward seal.

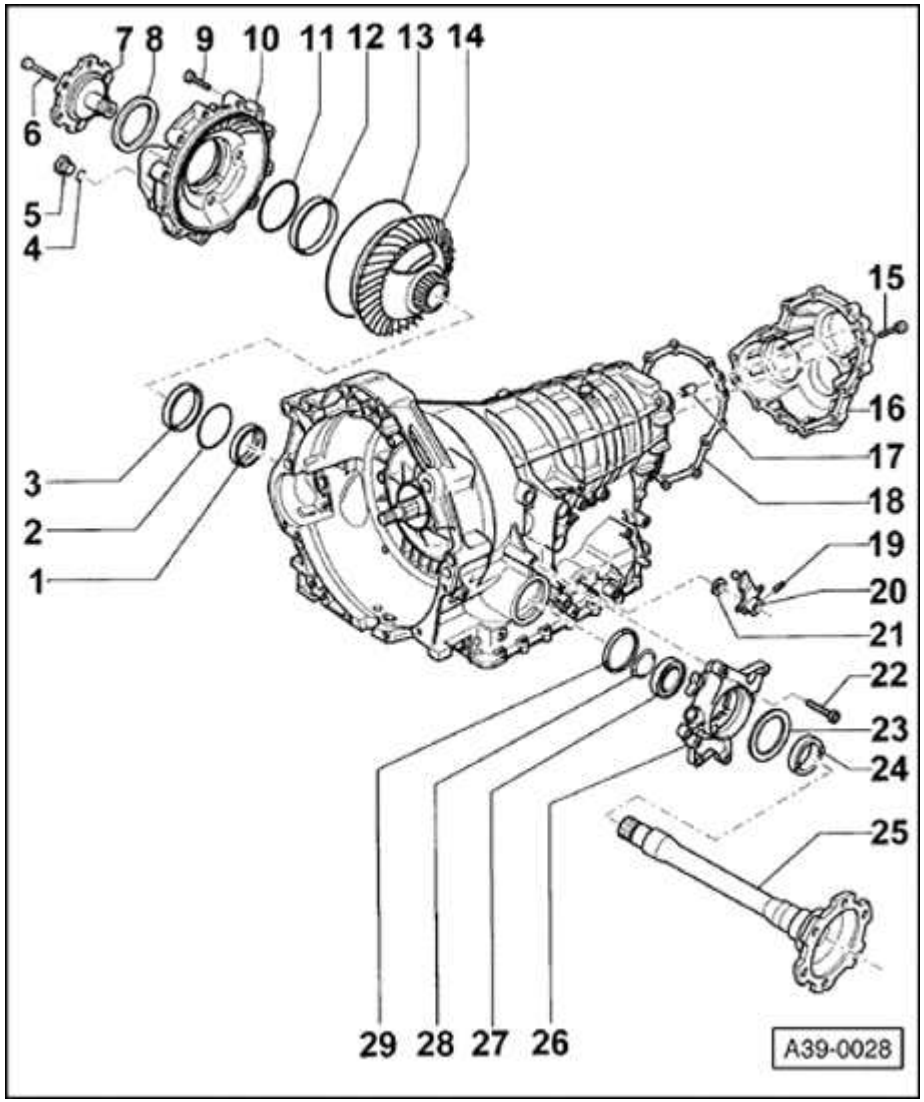
Note:

Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily.

Follower lugs engage in differential housing grooves.

- Replace seal for drive flange and install drive flange ⇒ Page 39-1 .
- Top up oil in transmission and check oil level ⇒ Page 34-39 .

39-5



Front final drive, servicing

- Transmission installed

Notes:

- *General repair notes* ⇒ *page 00-27* .
- *Rules of cleanliness for working on automatic transmissions* ⇒ *page 37-148* .

1 - Seal

- Between final drive and transmission housing
- Always replace ⇒ page 39-28

2 - Adjustment shim

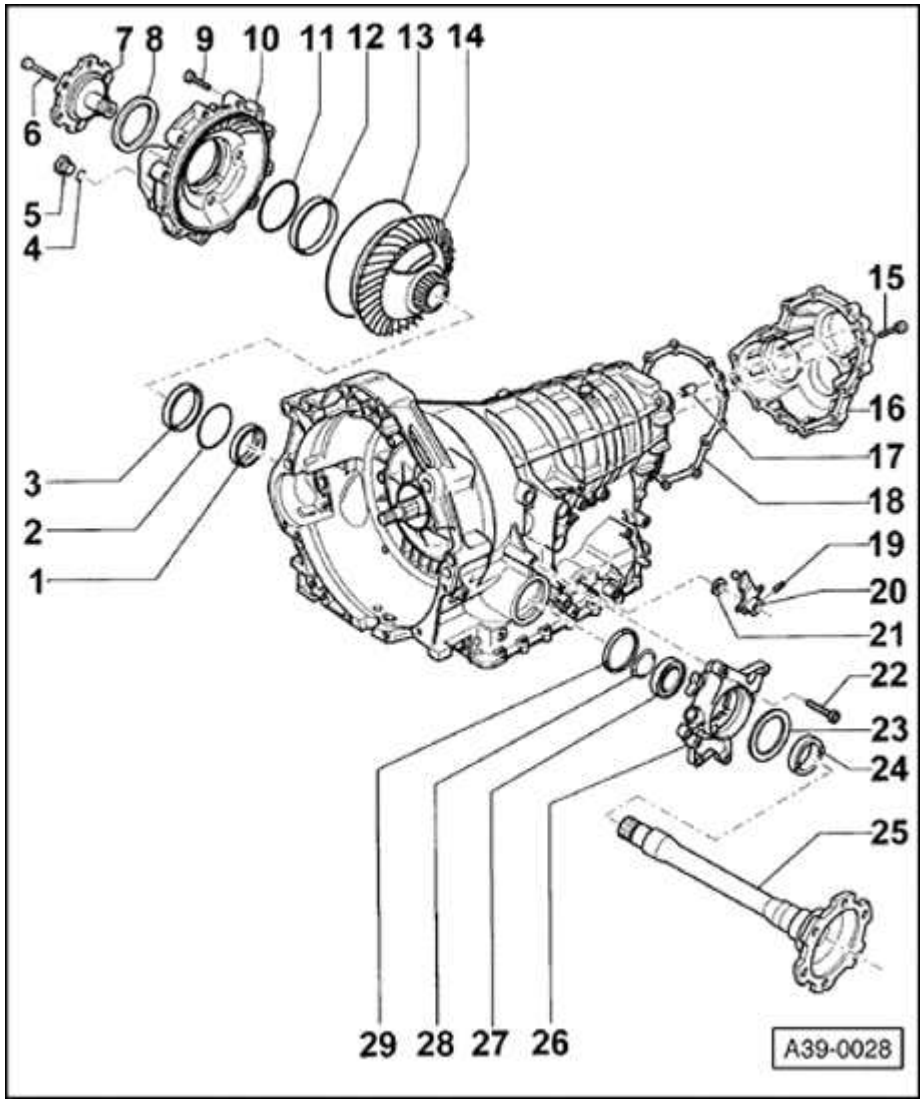
- Behind tapered roller bearing outer race

3 - Tapered roller bearing outer race

4 - O-ring

- Always replace

39-6



5 - Locking bolt - 30 Nm

6 - Bolt - 23 Nm

7 - Right drive flange

8 - Seal

- For right drive flange
- Always replace ⇒ page 39-9

9 - Bolt - 23 Nm

- Observe tightening sequence ⇒ page 39-36

10 - Cover for final drive

11 - Adjustment shim

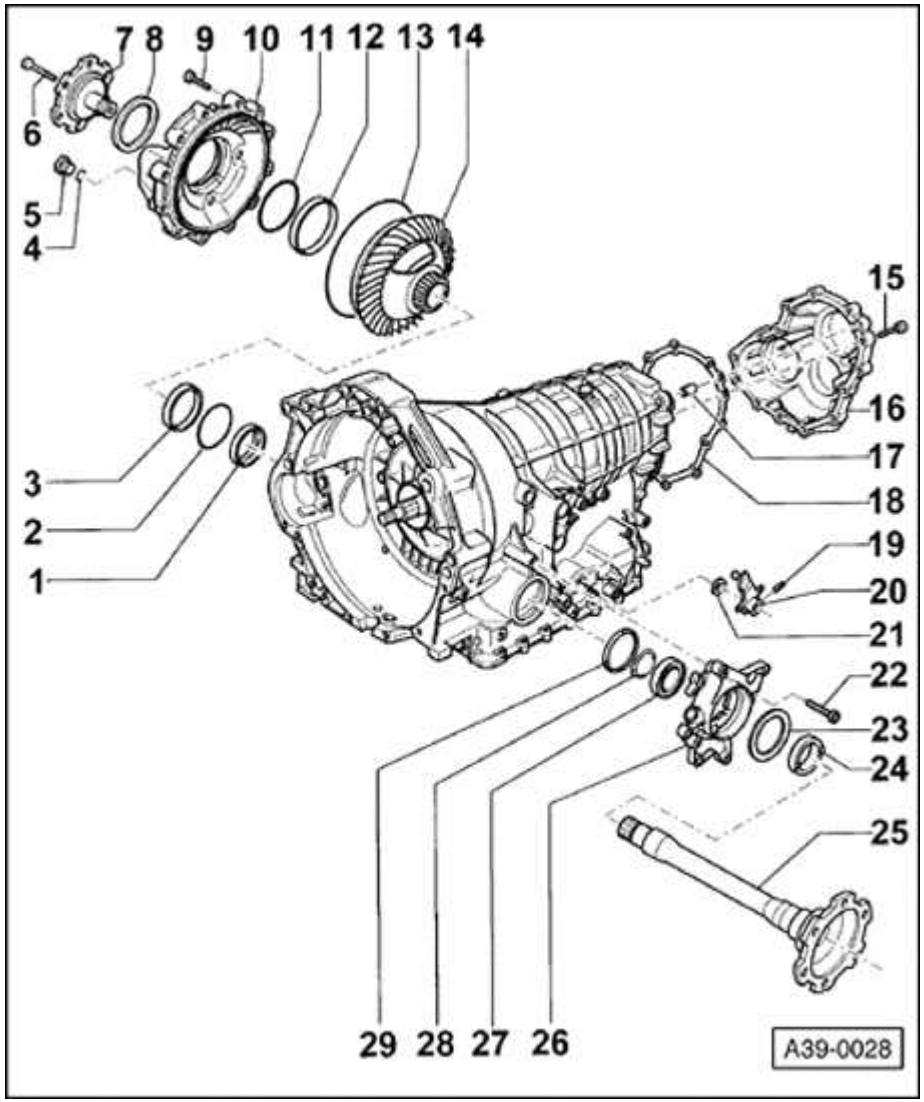
- Behind tapered roller bearing outer race

12 - Tapered roller bearing outer race

13 - O-ring

- Always replace ⇒ page 39-36

39-7



14 - Differential

15 - Bolt - 23 Nm

- Observe tightening sequence ⇒ page 39-27

16 - Cover for front final drive

- Shown here: Front wheel drive version
- All wheel drive version ⇒ page 39-52 , item 31

17 - Bushing

18 - Gasket

- Always replace ⇒ page 39-24

19 - Spring dowel sleeve

20 - Lever

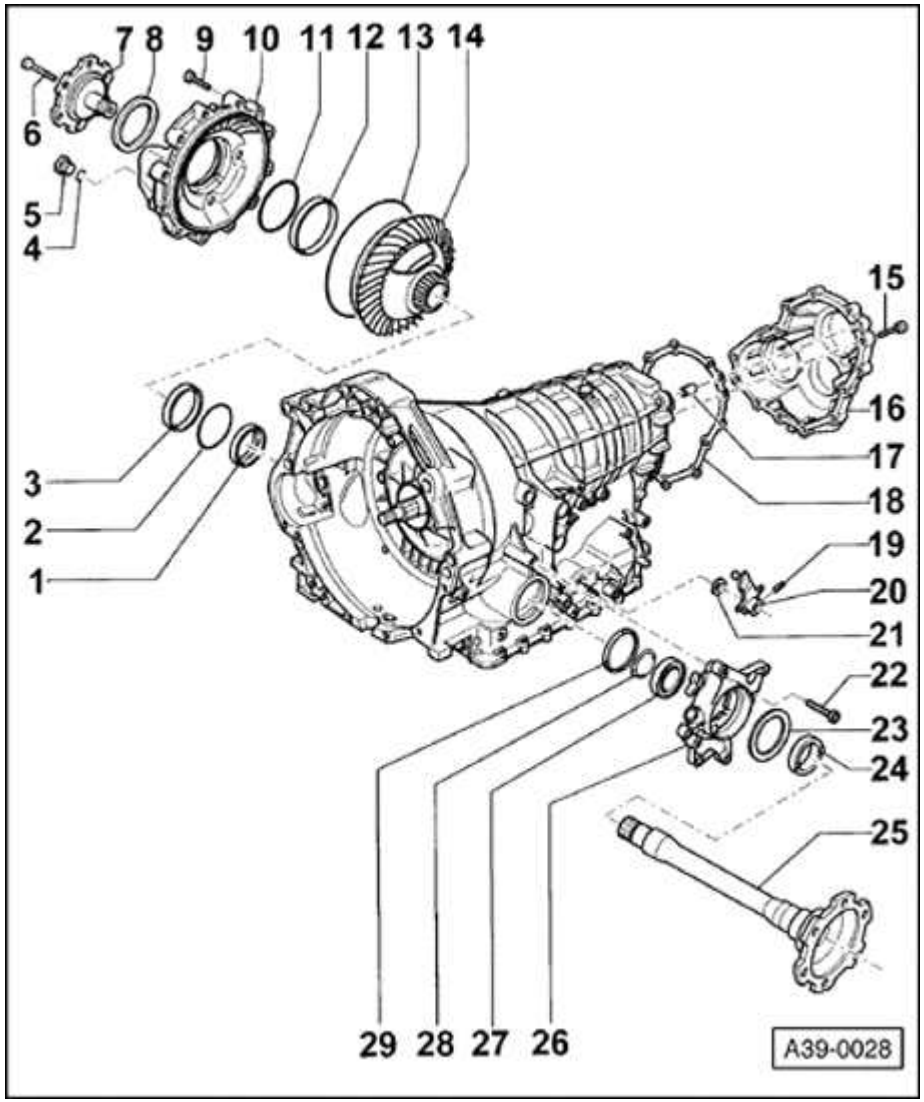
- For shift rod

21 - Seal

- For shift rod
- Always replace ⇒ page 38-31

22 - Bolt - 23 Nm

39-8



23 - Seal

- For left drive flange
- Always replace ⇒ page 39-13

24 - Drive gear

- For Speedometer Vehicle Speed Sensor (VSS) -G22-
- Installed position ⇒ page 39-20

25 - Left drive flange

- Removing and installing ⇒ page 39-13

26 - Mounting bracket for drive flange

27 - Grooved ball bearing for drive flange

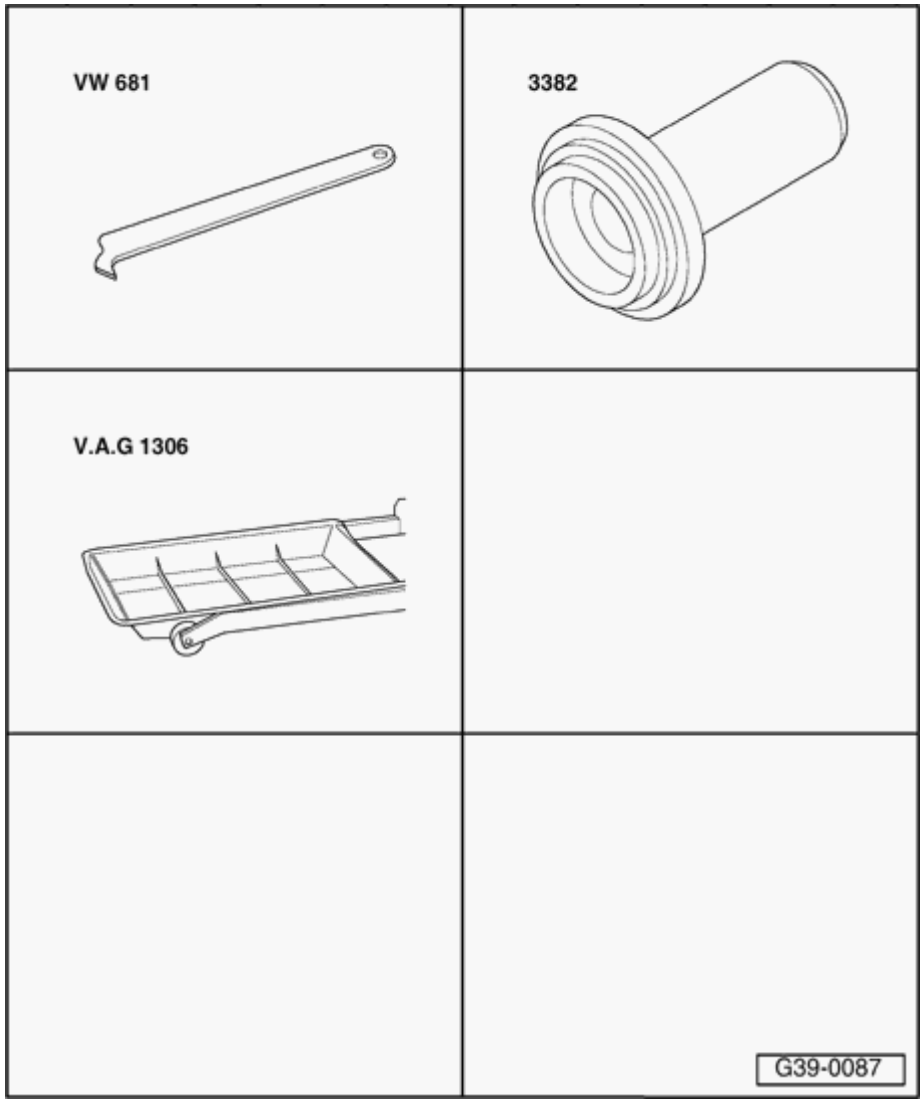
- Always replace ⇒ page 39-13

28 - Snap ring

29 - O-ring

- Square cross section
- Remove and install left drive flange to replace ⇒ page 39-13

39-9



Seal for right drive flange, replacing

Special Tools and equipment

- VW681 extractor lever
- 3382 right seal installer
- VAG1306 drip tray

Removing

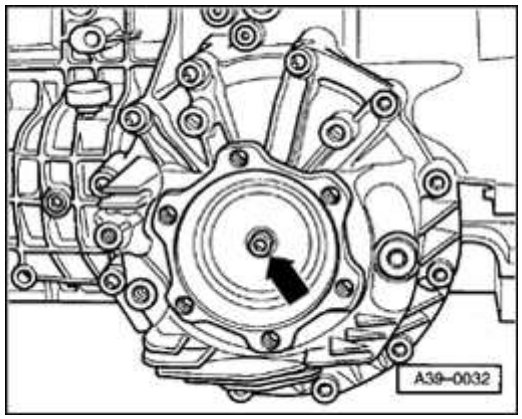
- Loosen bolt drive axle/wheel hub while the vehicle is still standing on its wheels.

- Remove wheel.

- Remove heat shield for right drive axle.

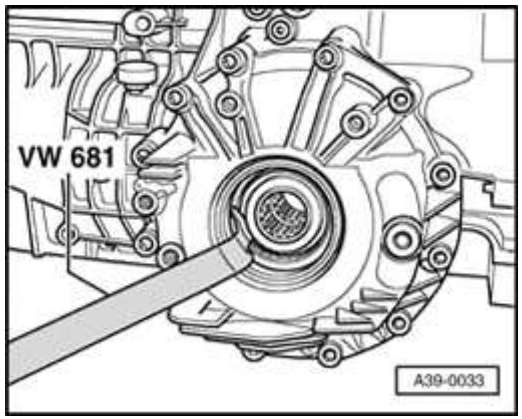
- Remove right drive axle:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*



- Remove bolt for flange shaft (arrow) while securing against turning using a drift.
- Place VAG1306 drip tray underneath.

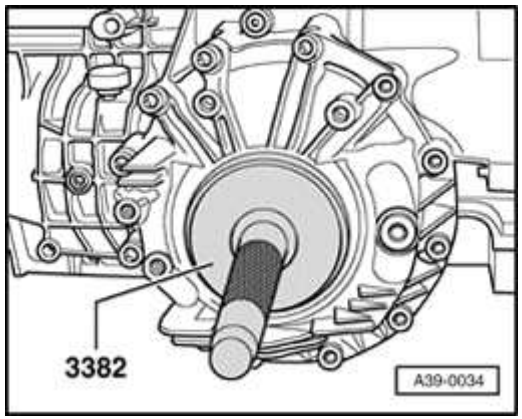
- Remove right drive flange.



- Drive flange seal, pulling out.

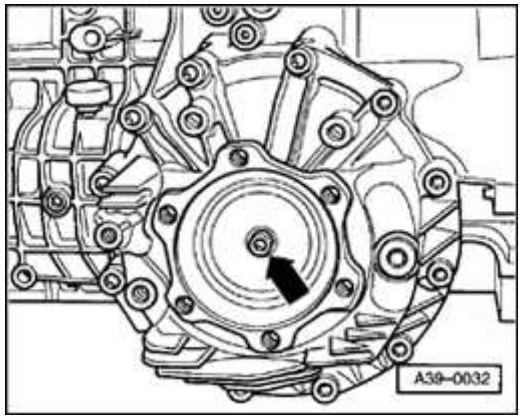
Installing

- Coat outer edge of oil seal with gear oil.



- Drive in new seal to stop, without canting.
  - ♦ Installation position: The open side of the seal faces the transmission.
- Install right drive flange.

39-12



- Install bolt for drive flange (arrow, 23 Nm) while securing drive flange against turning, using a drift.
- Install drive axle.

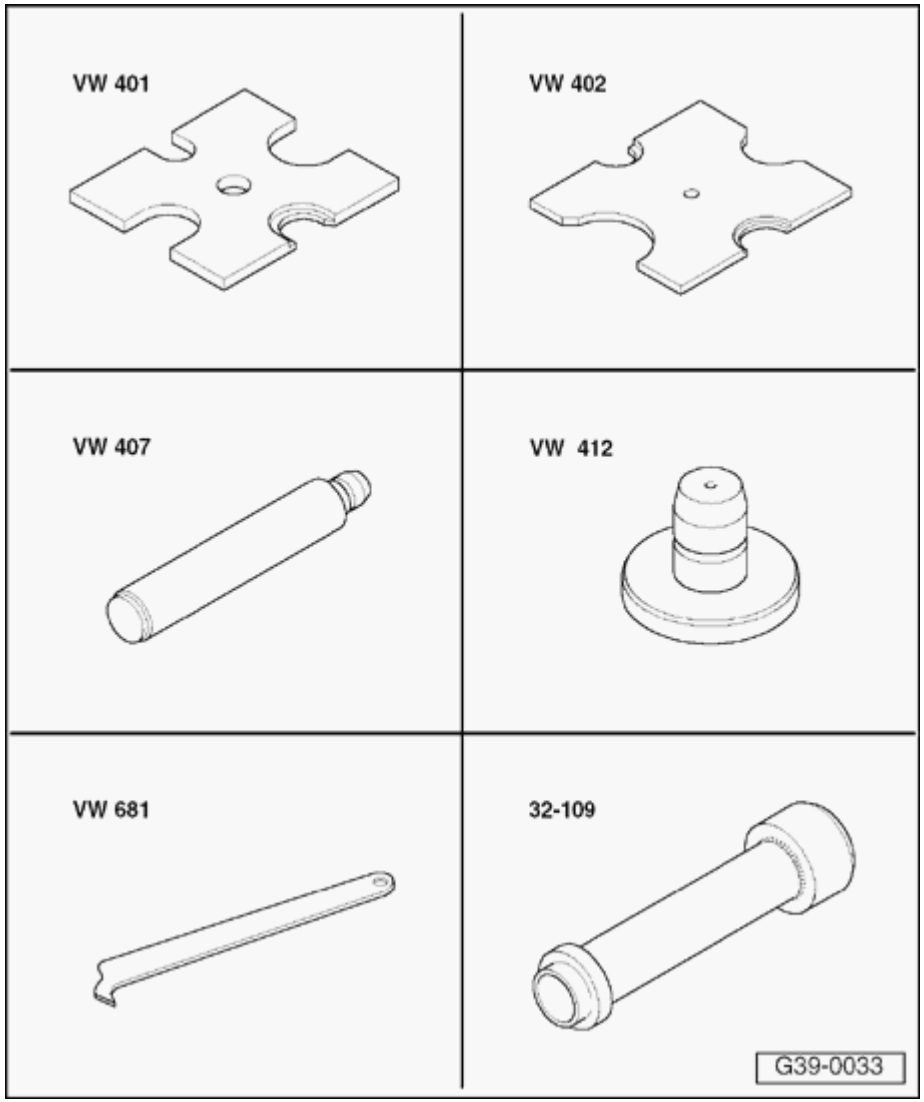
⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Install heat shield for right drive axle.
- Checking oil level in front final drive ⇒ page 39-1 .

Tightening torques

Component	Nm
Drive flange to transmission	23
Drive axle to drive flange M10	77
Driveshaft to drive flange M8	39
Heat shield for driveshaft to transmission	23

39-13

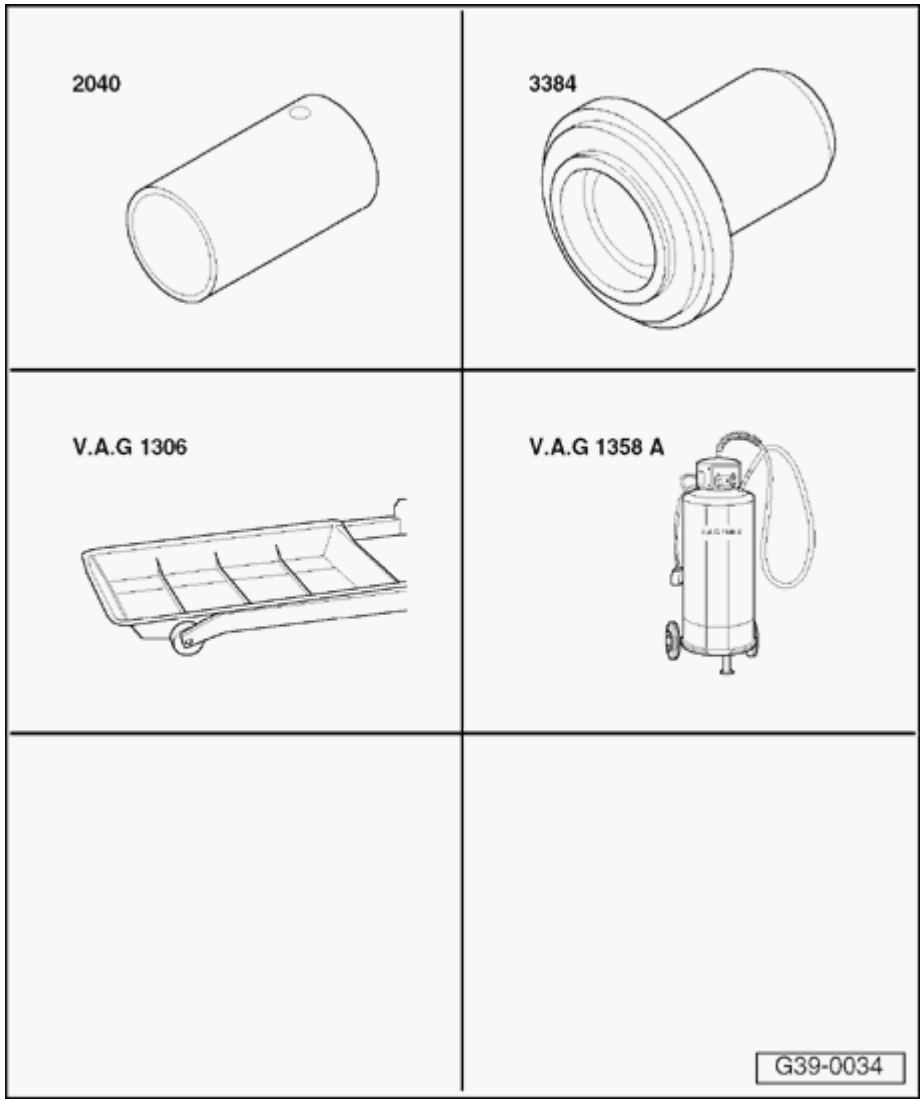


Seal and grooved ball bearing for left drive flange, replacing

Special Tools and equipment

- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW412 punch
- VW681 extractor lever
- 32-109 driving sleeve

39-14



- 2040 press tube
- 3384 assembly mandrel
- VAG1306 drip tray
- VAG1358A - oil siphoning unit

39-15

Remove left drive flange

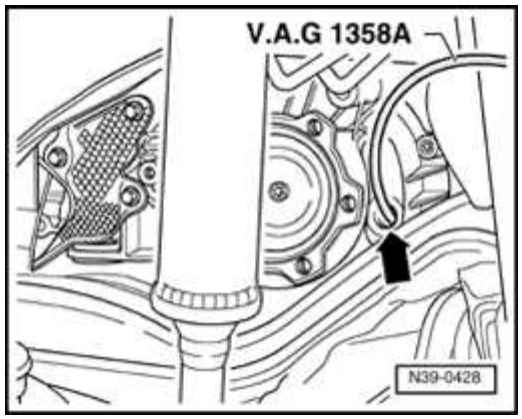
- Loosen bolt drive axle/wheel hub while the vehicle is still standing on its wheels.

- Remove wheel.

- Removing left drive axle:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Place VAG1306 drip tray underneath.



- Remove oil filler plug (arrow) and syphon off at least 0.5 L gear oil from final drive using VAG1358A.

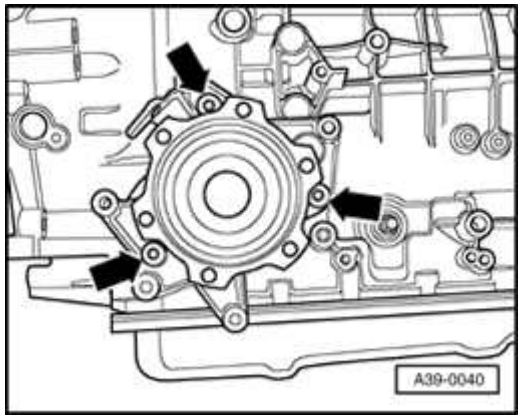
Note:

Oil must be syphoned from final drive, otherwise there is a risk that the gear oil could mix with the ATF.

- Remove heat shield for left drive axle.
- Remove Speedometer Vehicle Speed Sensor (VSS) ⇒ page 38-35 .
- Remove harness connector bracket from mounting bracket for drive

flange.

39-16



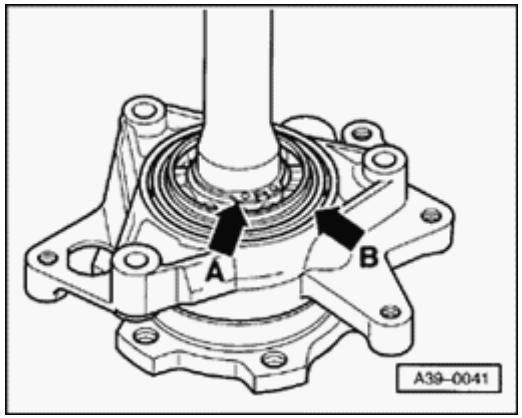
- Remove drive flange mounting bracket (arrows).
- Pull out drive flange.

Note:

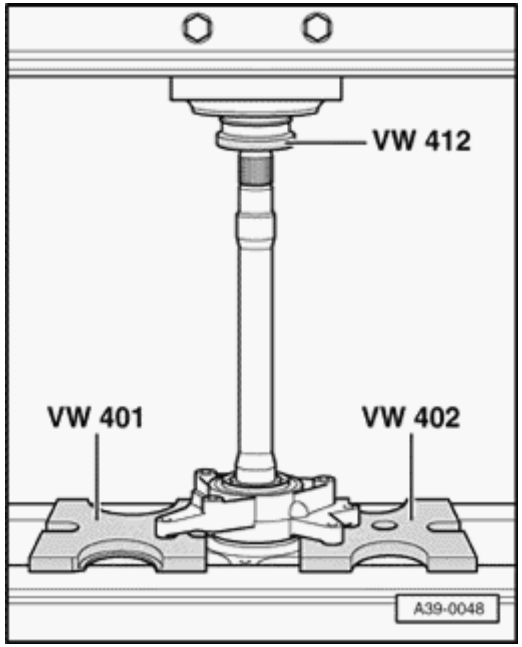
The left drive flange can be pulled out between body and subframe with the transmission installed if the drive flange mounting bracket is turned approx. 60° to the right against the installed position.

39-17

Removing seal



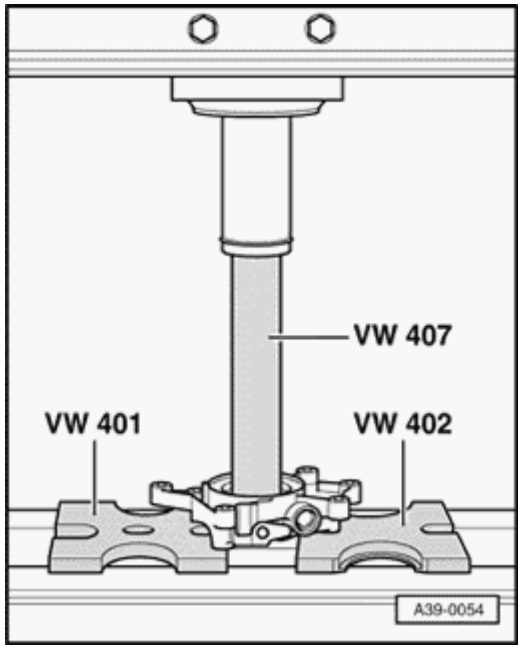
- Remove circlip for grooved ball bearing (arrow A).



- Press drive flange out of drive flange mounting bracket.
- Remove drive flange seal using VW681 extractor lever.

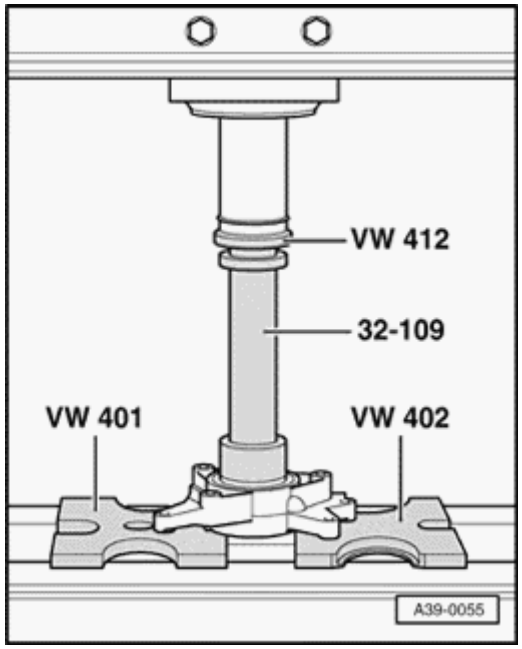
39-18

Removing grooved ball bearing



- Press grooved ball bearing out of mounting bracket.

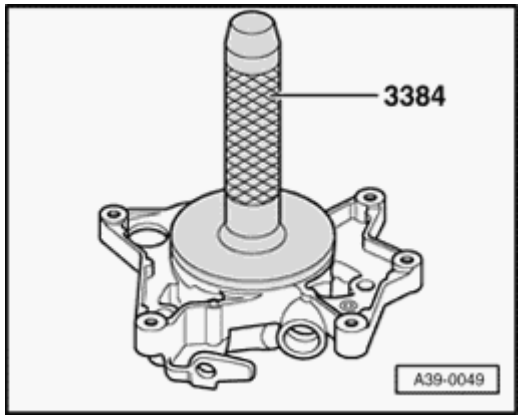
Installing grooved ball bearing



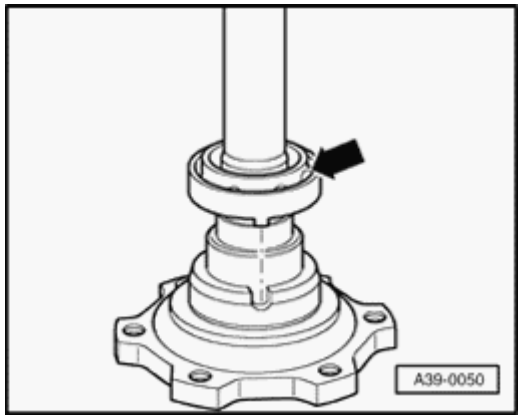
- Press new grooved ball bearing into mounting bracket.

Installing seal

- Coat outer edge and sealing lip of oil seal with gear oil.



- Drive in new seal to stop, without canting.
  - Installation position: The open side of the seal faces the transmission.

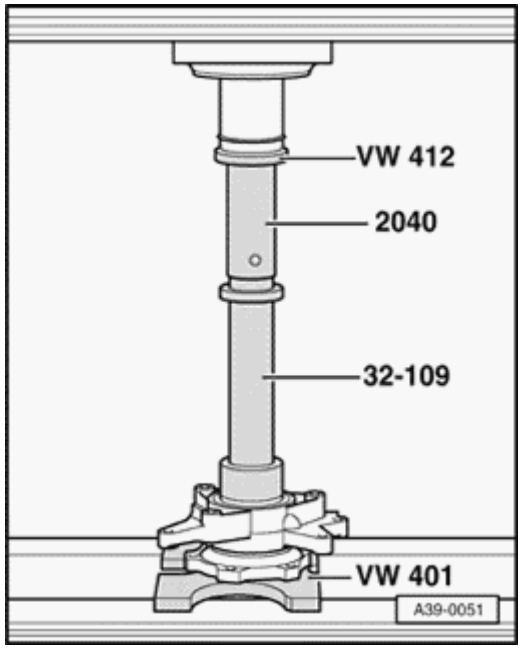


- Set Speedometer Vehicle Speed Sensor (VSS) -G22- on drive flange (arrow).
  - Installation position: The carriers at drive wheel must engage in grooves of drive flange

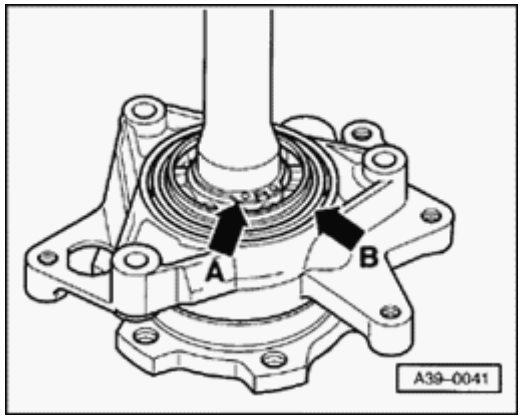
Note:

If necessary, coat contact surface with grease to affix drive wheel in installation position.

39-21



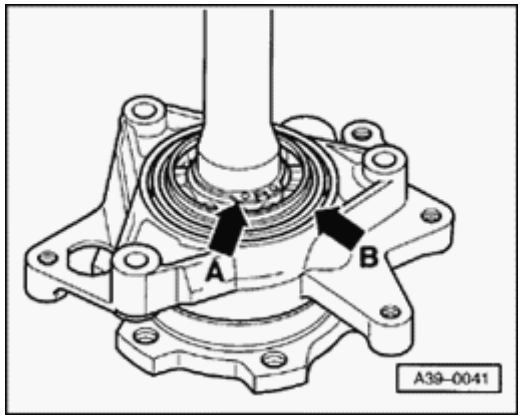
- Press mounting bracket with grooved ball bearing onto drive flange.



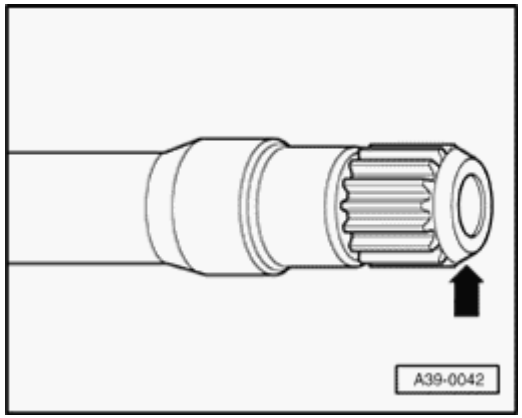
- Insert circlip (arrow A).

39-22

Installing left drive flange.



- Replace O-ring (arrow B) in drive flange mounting bracket.



- Check drive flange for sharp edges on transmission side of flange end and if necessary, deburr.
- Insert left drive flange into transmission.

Note:

When sliding in, left drive flange must be carefully guided by hand to prevent damage to the double seal in transmission.

- Install drive axle.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Install heat shield for left drive axle.
- Checking oil level in front final drive ⇒ page 39-1 .

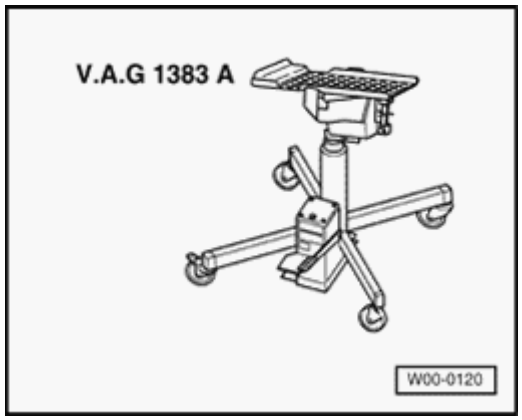
Tightening torques

Component	Nm
Mounting bracket for left drive flange at transmission	23
Drive axle to drive flange M10	77
Driveshaft to drive flange M8	39
Heat shield for driveshaft to transmission	23

39-24

Seal for front final drive, replacing

Special tools and equipment



- VAG1383A engine/transmission hoist

Removing

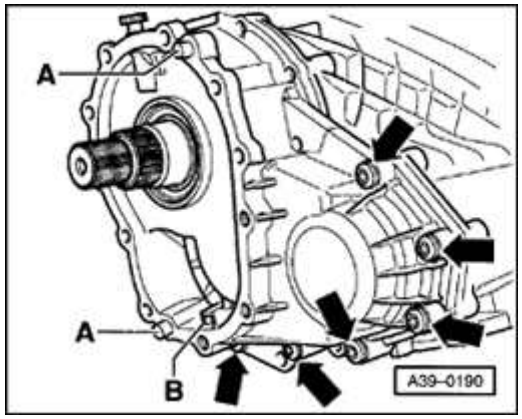
- Remove right front exhaust pipe:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

- Remove heat shield for selector lever cable.

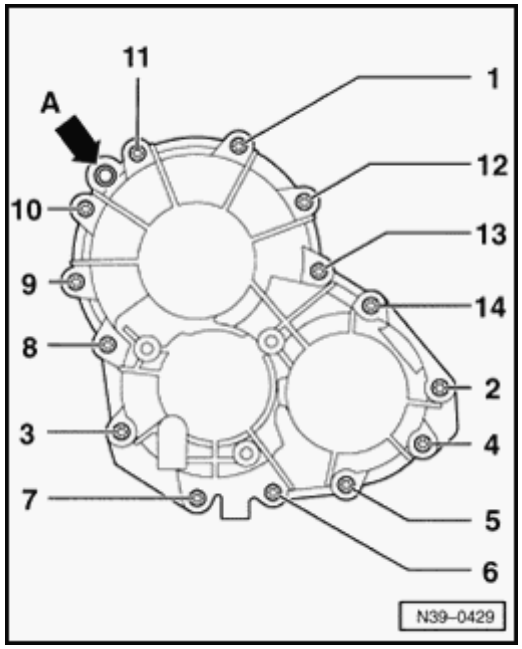
All Wheel Drive (AWD) vehicles:

- Remove center differential ⇒ page 39-56 .



- Remove bolts (arrows) at intermediate flange for front final drive.

39-25



Front Wheel Drive (FWD) vehicles:

- Remove bolts at cover for front final drive opposite of shown tightening sequence.
- Place VAG1383A engine/gearbox jack with universal mount underneath.

WARNING!

- ***Slowly and carefully remove cover for front final drive from transmission housing. The spur gears can otherwise fall out of the transmission.***
- ***Do not reinstall spur gears that have fallen to the ground. The transmission must be swapped in this case.***

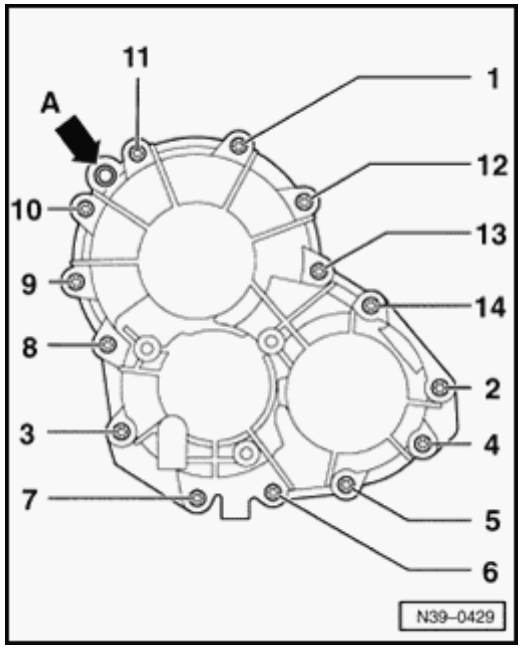
All:

- Lift off cover i.e. intermediate flange for front final drive.

Notes:

- *Do not remove spur gears for front final drive. Secure spur gears so they do not fall out.*
- *If the spur gears for front final drive were removed, the wheel marking must face outward (away from transmission) for re installation.*

39-26



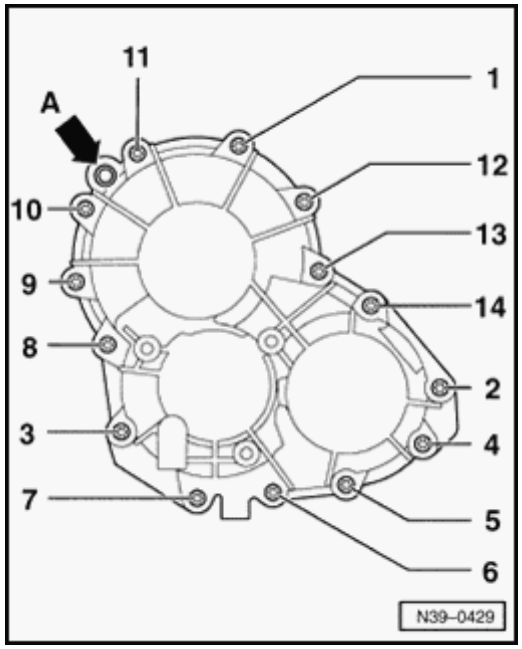
Installing

- Make sure centering sleeve -A-is correctly seated before installing.
- Install gasket
- Set on cover i.e. intermediate flange for front final drive.

All Wheel Drive (AWD) vehicles:

Note:

If installing the intermediate flange to the output shaft carelessly, the sealing lips of the seal can be damaged.



All:

Tightening sequence:

- 1. Stage: Tighten bolts 1 to 3 by hand

Note:

When tightening bolts by hand, make sure the housing gap between cover and transmission housing decreases evenly around circumference.

- 2. Stage: Tighten bolts 1 to 14 in mentioned sequence to tightening torque.

- Check ATF level and top off ⇒ page 37-133 .

All Wheel Drive (AWD) vehicles:

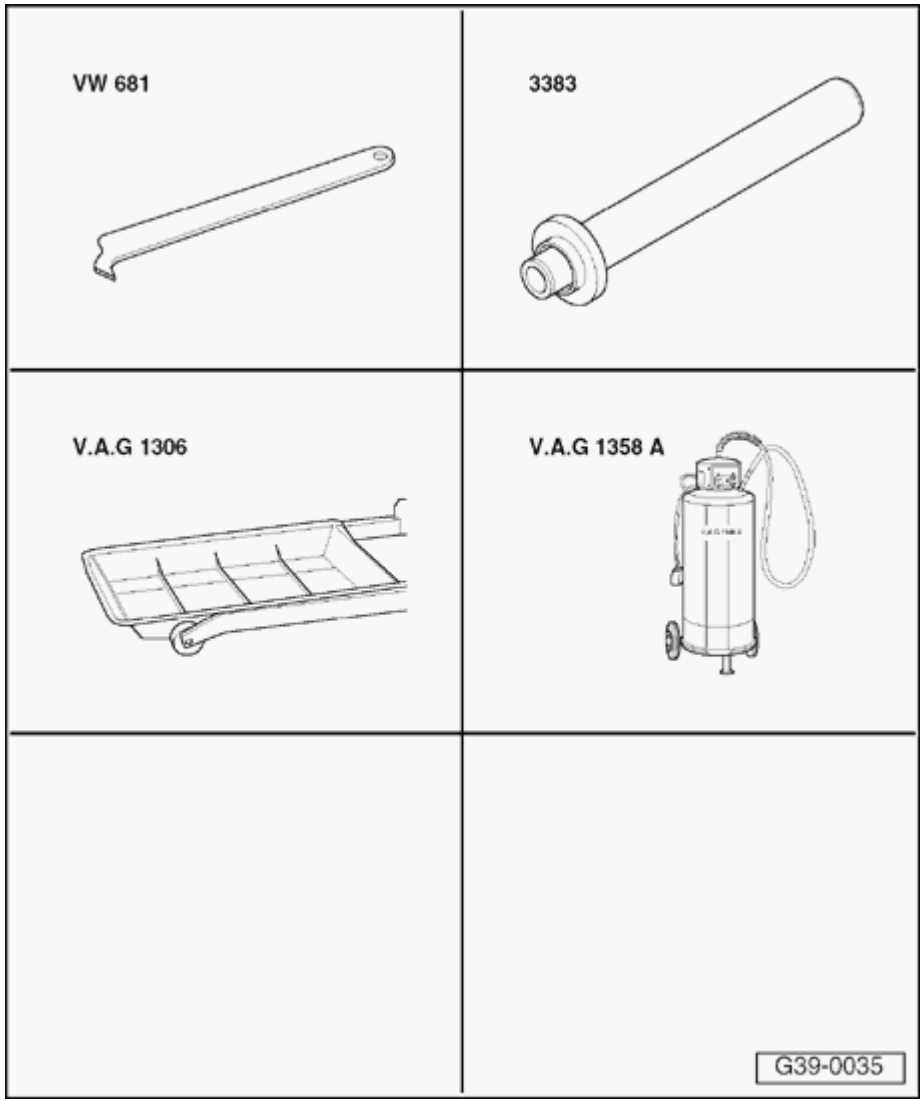
- Install center differential ⇒ page 39-58 .

Tightening torques

Component	Nm
Cover for front final drive to transmission housing	23
Intermediate flange for front final drive to transmission housing	23

Center differential to transmission housing	23

39-28



Final drive to transmission housing seal, replacing

Special Tools and equipment

- VW681 extractor lever
- 3383 double seal installer
- VAG1306 drip tray
- VAG1358A - oil siphoning unit

39-29

Notes:

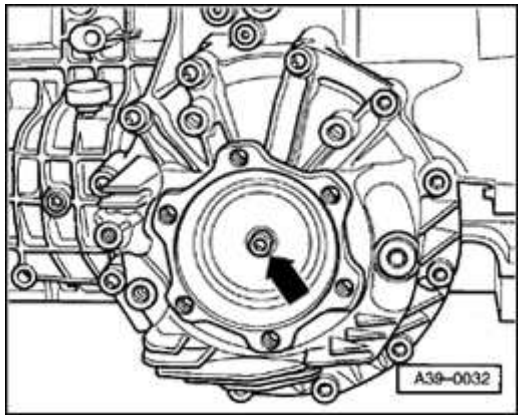
- *A faulty seal lets ATF or gear oil escape into the converter housing via the center vent of the shaft seal (between the two sealing lips).*
- *In addition, a faulty seal can let ATF escape into the center differential. It over-fills and oil escapes at the differential vent.*

Removing

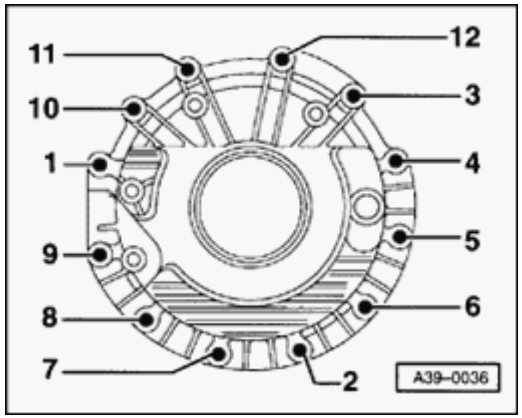
- Loosen bolt drive axle/wheel hub while the vehicle is still standing on its wheels.
- Remove front wheels.
- Remove heat shield for right drive axle.
- Remove drive axles:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

39-30

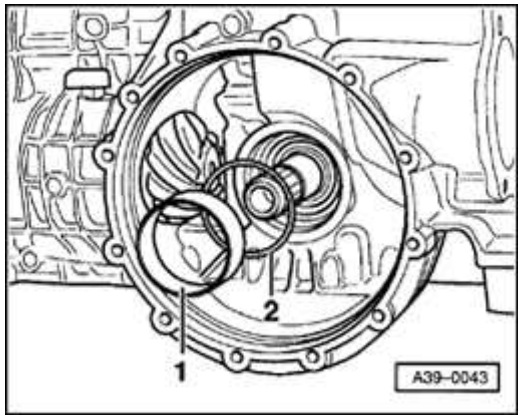


- Remove bolt for flange shaft (arrow) while securing against turning using a drift.
- Using VAG1358A oil siphoning unit, siphon gear oil from the final drive.
- Place VAG1306 drip tray underneath.
- Remove right drive flange.
- Remove right transmission support ⇒ page 37-125 .



- Remove bolts for final drive cover opposite of shown tightening sequence and remove cover.
- Pull out differential and remove.

39-31

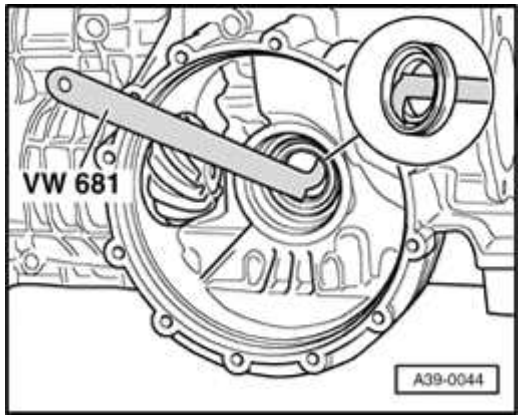


- Remove tapered roller bearing outer race of differential -1- and shim -2- which is behind it from transmission housing by hand.

Note:

Shim is pre-determined and must not be exchanged for a shim with another thickness.

- Remove left drive flange ⇒ page 39-13 .



- Pull out seal.

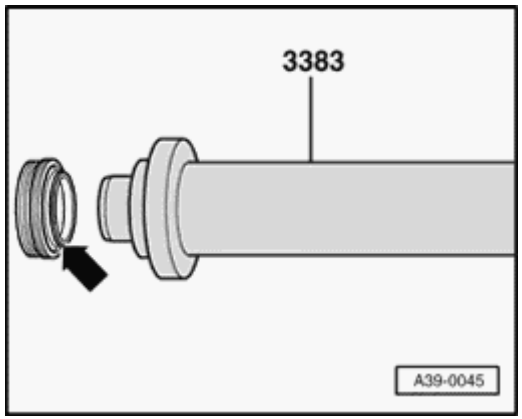
Note:

Extractor lever must be positioned behind both sealing lips of the seal. Do not position at outer circumference of seal, otherwise the contact surface in transmission housing will be damaged. When levering out, carefully guide extractor lever.

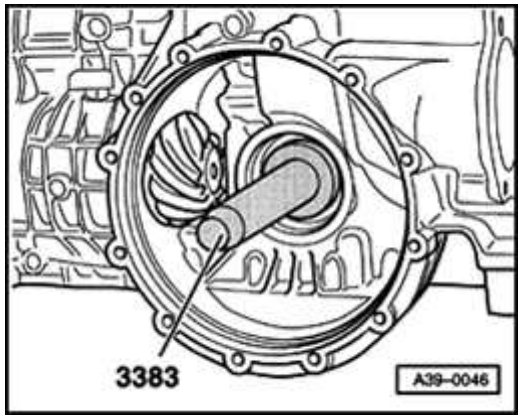
Installing

- Check seal seat in transmission housing for damage; rework if necessary.

- Coat outer circumference and sealing lip of seal with ATF.

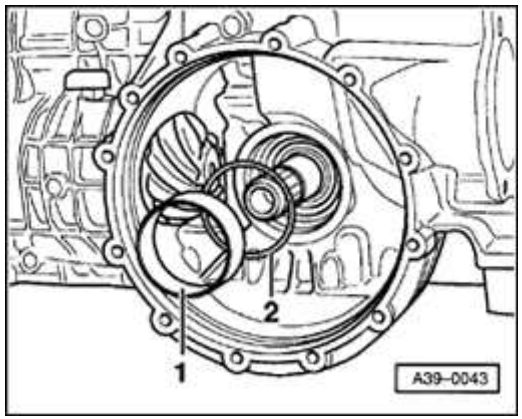


- Slide seal onto 3383 double seal installer so that the projecting sealing lip (arrow) of seal faces tool.

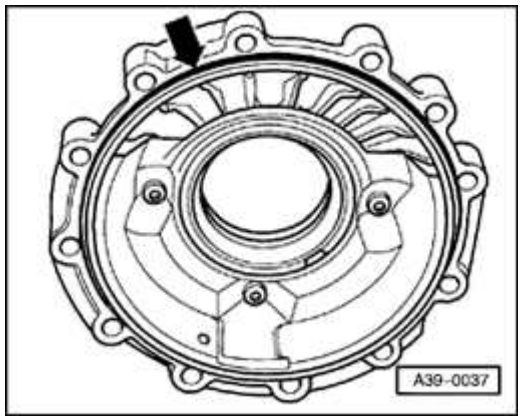


- Drive in new seal to stop.

- Install left drive flange ⇒ page 39-22 .

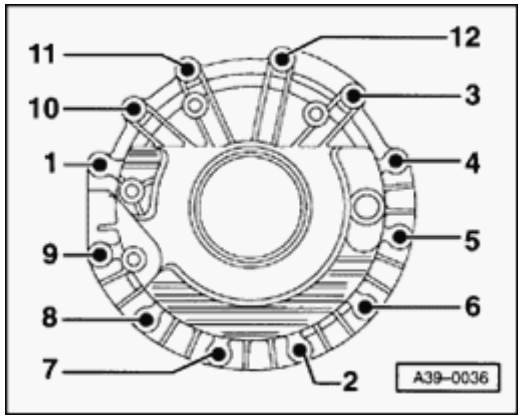


- Insert adjustment shim -2- and tapered roller bearing outer race for differential -1- into transmission housing up to stop by hand.



- Replace O-ring (arrow).
- Insert differential into transmission housing.

39-34



- Install cover for final drive.

Tightening sequence:

- 1. Stage: Tighten bolts 1 to 3 by hand
- 2. Stage: Tighten bolts 1 to 12 in mentioned sequence to tightening torque.

- Install right drive flange.
- Install right transmission support ⇒ page 37-125 .
- Installing drive axles:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Top-up and check gear oil in front final drive ⇒ page 39-1 .

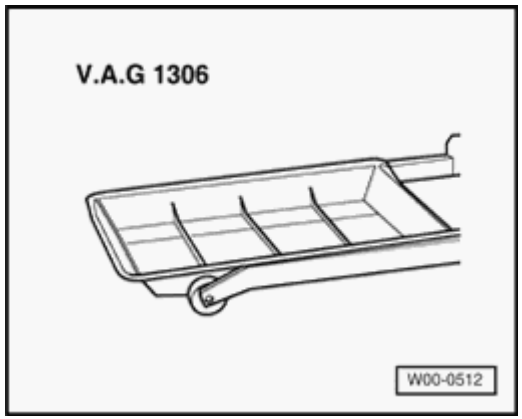
Tightening torques

Component	Nm
Cover for front final drive to transmission housing	23
Mounting bracket for left drive flange at transmission	23
Drive flange to transmission	23
Drive axle to drive flange M10	77
Driveshaft to drive flange M8	39
Heat shield for driveshaft to transmission	23

39-36

O-ring at cover for final drive, replacing

Special tools and equipment



- VAG1306 drip tray

Removing

- Loosen bolt drive axle/wheel hub while the vehicle is still standing on its wheels.
- Remove right wheel.
- Remove heat shield for right drive axle.
- Remove right front exhaust pipe:

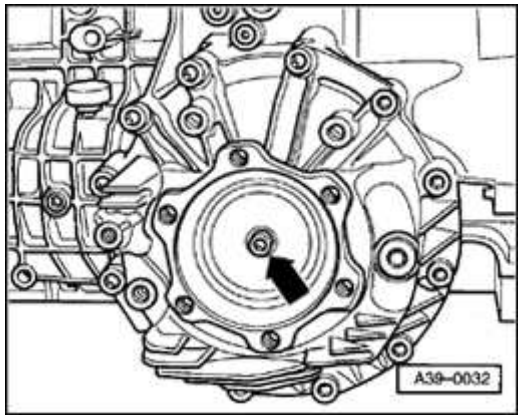
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system.*

39-37

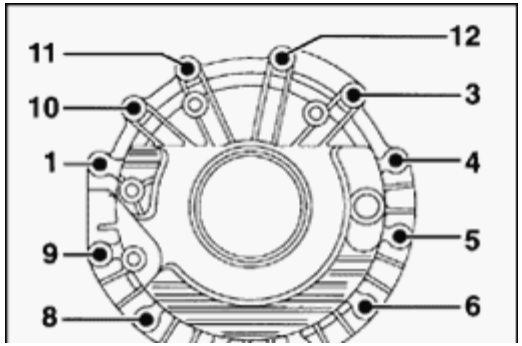
- Remove right drive axle:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Remove right transmission support ⇒ page 37-125 .



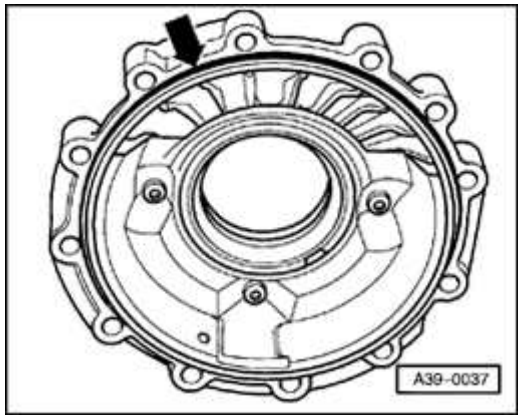
- Remove bolt for flange shaft (arrow) while securing against turning using a drift.
- Place VAG1306 drip tray underneath.
- Remove right drive flange.



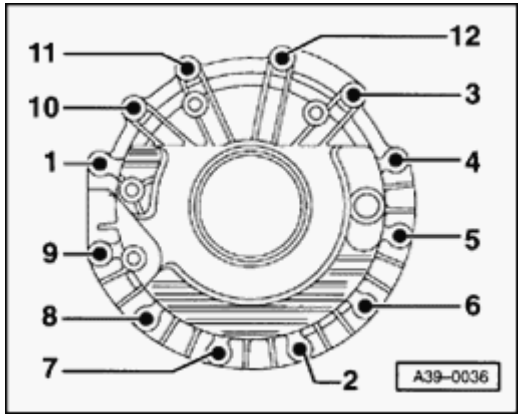
- Remove bolts for final drive cover opposite of shown tightening sequence and remove cover.

39-38

Installing



- Replace O-ring (arrow).



- Install cover for final drive.

Tightening sequence:

- 1. Stage: Tighten bolts 1 to 3 by hand
- 2. Stage: Tighten bolts 1 to 12 in mentioned sequence to tightening torque.

- Install right drive flange.

- Install right transmission support ⇒ page 37-125 .

- Install drive axle.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40; Drive axle, removing and installing*

- Top-up and check gear oil in front final drive ⇒ page 39-1 .

Tightening torques

Component	Nm
Cover for front final drive to transmission housing	23
Drive flange to transmission	23
Heat shield for driveshaft to transmission	23

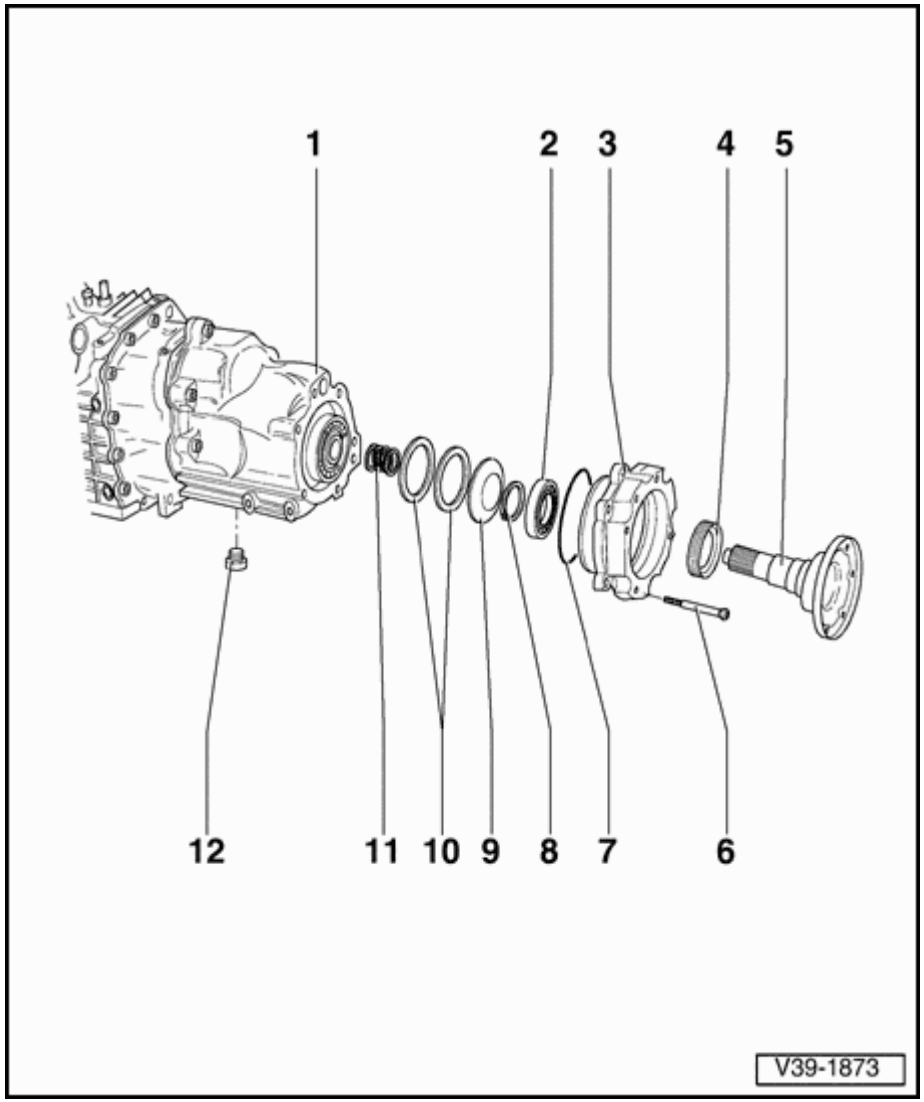
Seal and grooved ball bearing for flange for driveshaft on transmission, replacing

Special tools, testers and auxiliary items required:

- Drip tray V.A.G 1306
- Adapter VW 295a
- Thrust plate VW 401
- Thrust plate VW 402
- Press tool VW 407
- Tube VW 415a
- Tube VW 416b
- Press tool VW 433
- Thrust pad VW 454
- Extractor lever VW 681

- Multi-purpose tool 771/1 with attachment 771/15 and stud M8/M10
- Punch 2005
- Shim, Part No. 016 311 391 B

39-7



1 - Transmission

2 - Grooved ball bearing

3 - Bearing housing on balance weight

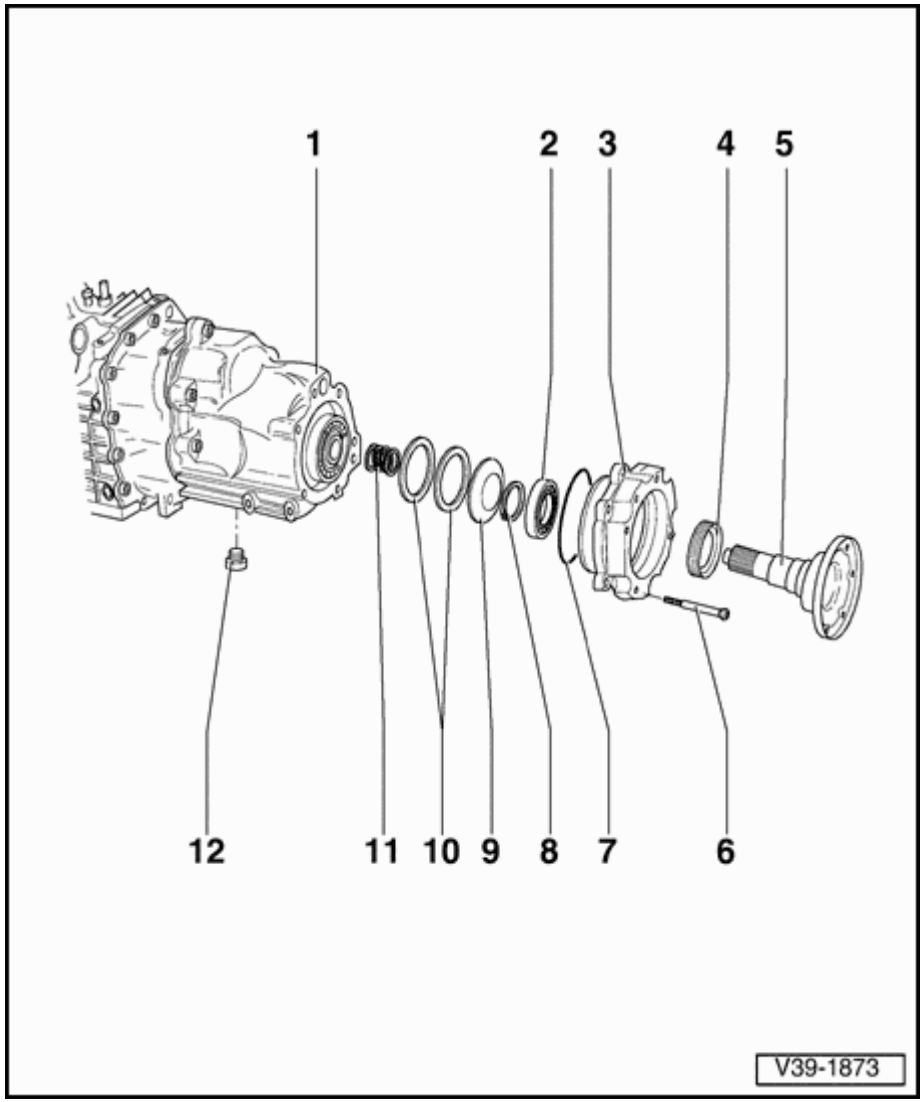
4 - Seal

- Driving in ⇒ Page 39-13

5 - Drive flange

6 - Bolt, 25 Nm

- Qty. 6



7 - O-ring

- Always replace

8 - Circlip

9 - Spring plate

- Mark installation position when removing: larger diameter (concave side) toward shims - 10

10 - Shims

11 - Spring

12 - Oil drain plug, 40 Nm

39-9

Removing

- Transmission installed

- Disconnect driveshaft at the front ⇒ Page 39-68 , lift clear and tie-up on selector linkage.

- Place a drip tray underneath.

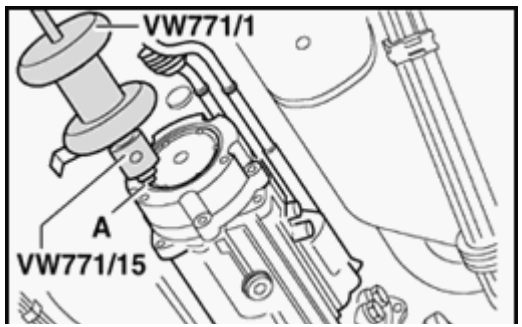
- Unscrew rear oil drain plug (on end cover) and drain transmission oil.

- Unscrew securing bolts for bearing housing.

Note:

Generally, the bearing housing is pressed out via the spiral spring when loosening bolts from cover.

If the bearing housing is not pressed off:



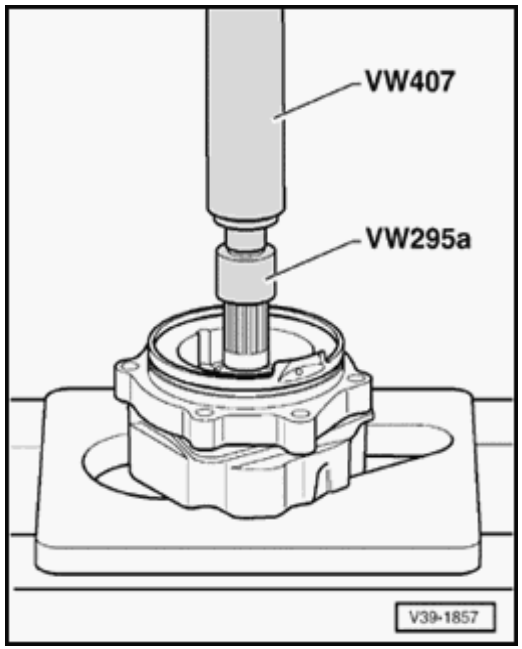
- Pull drive flange together with bearing housing and balance weight off end cover.

A - M8/M10 stud

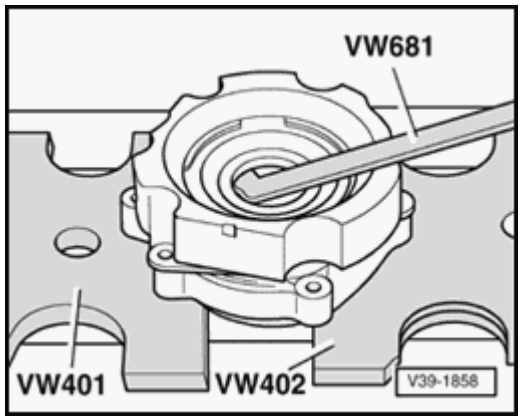
- Take off bearing housing.

39-10

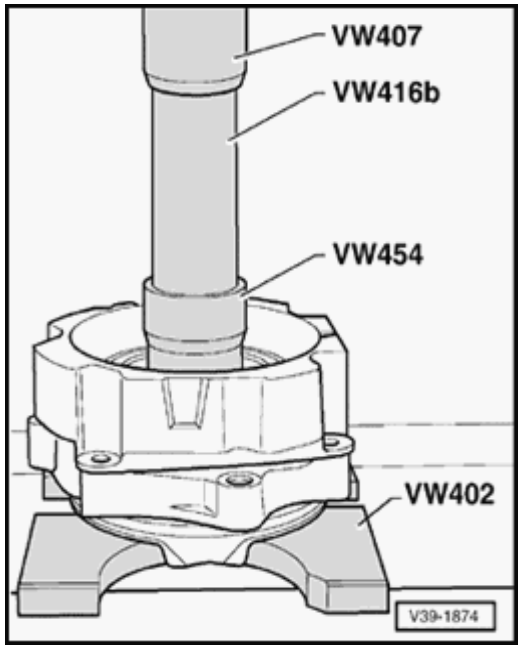
- Take circlip off drive flange.



- Press out drive flange.

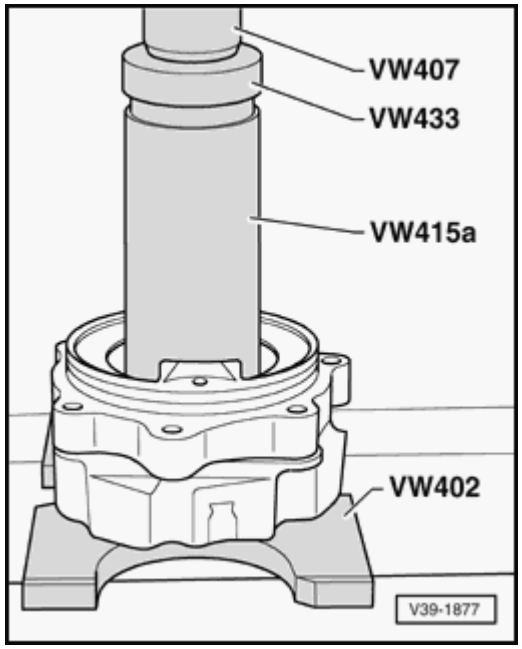


- Pull out seal for drive flange.
- Thoroughly clean seal seat.

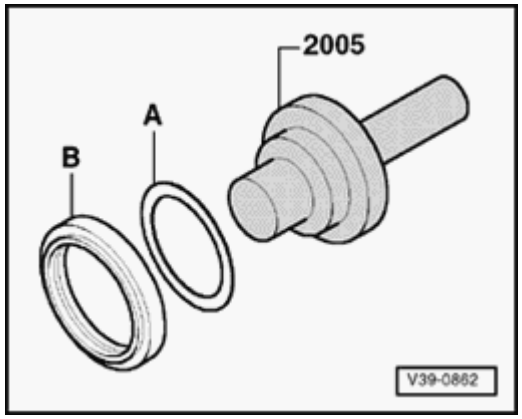


- Press out grooved ball bearing.

Installing

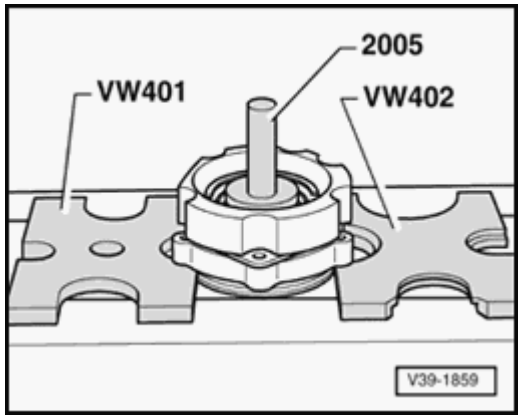


- Press grooved ball bearing in bearing housing.

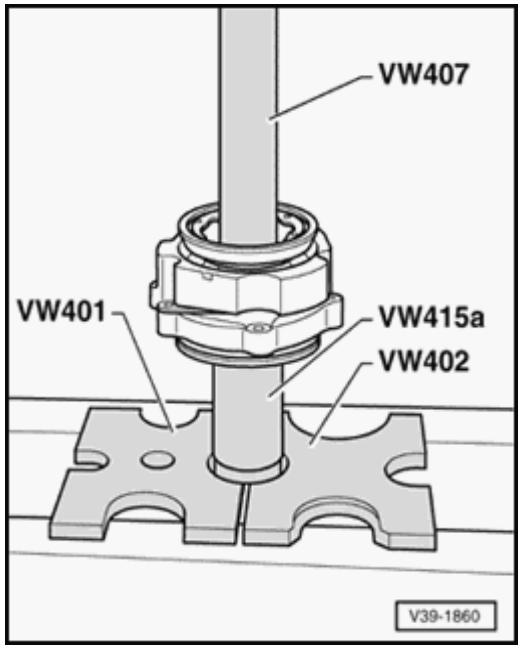


- Lightly oil outer circumference of seal -B-.
- Fill space between sealing lips and dust lips with sealing grease G52 128 A1.
- Fit seal with shim -A-, Part No. 016 311 391 B (1.7 mm thick) onto punch 2005.

  Installation position: open side of seal toward transmission.



- Drive in seal for drive flange.
- Remove shim after driving in.



- Press in drive flange.
- Fit circlip onto drive flange.
- Lightly oil O-ring and fit into bearing housing groove.
- Insert spring plate and shims into bearing housing.

  Installation position: ⇒ Page 39-8
- Slide coil spring onto drive flange.
- Tighten securing bolts for bearing housing in diagonal sequence and in stages to 25 Nm.
- Bolt on driveshaft ⇒ Page 39-71 .
- Top up oil in transmission and check oil level ⇒ Page 34-39 .

Drive flange and driveshaft seals, replacing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

Special tools and equipment

- VW681 extractor lever
- 30-505 mandrel
- 30-506B press support
- 3337 ring spanner 7-piece set for heated oxygen sensor
- VAG1306 drip tray

Removing

4-cylinder engine

- Remove rear section of exhaust system located rearward of exhaust pipe clamp.

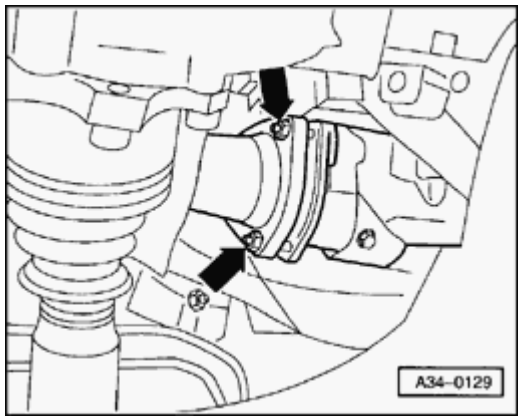
⇒ Repair Manual, Engine Mechanical, Repair Group 26

39-8

6-cylinder engine

- Remove Heated Oxygen Sensor (HO2S) from right exhaust pipe using 3337 ring spanner 7-piece set and move clear to side.

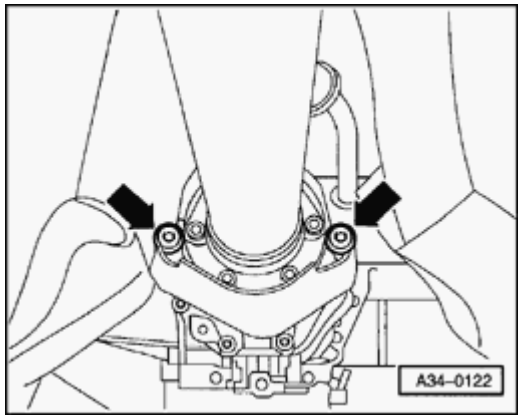
- Remove heat shield above right drive axle.



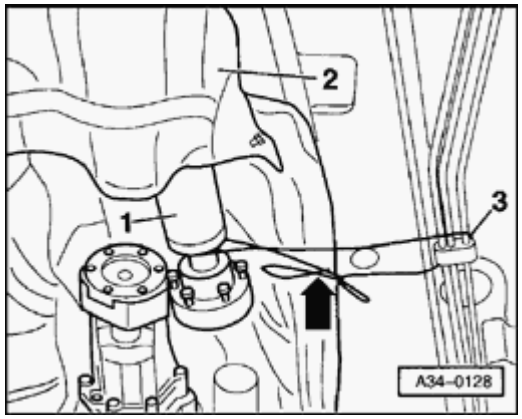
- Remove right front exhaust pipe with Three Way Catalytic Converter (TWC) from exhaust manifold (3 nuts, arrows).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

All models

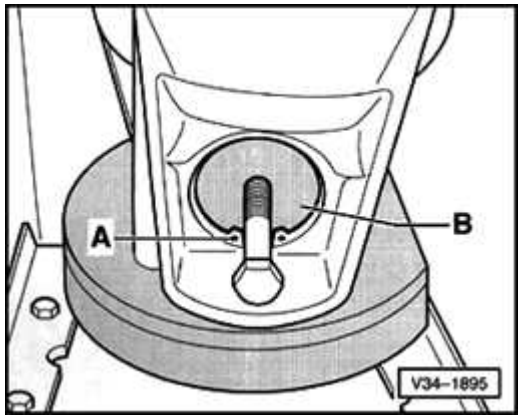


- Remove heat shield for driveshaft from Torsen differential cover (arrows).



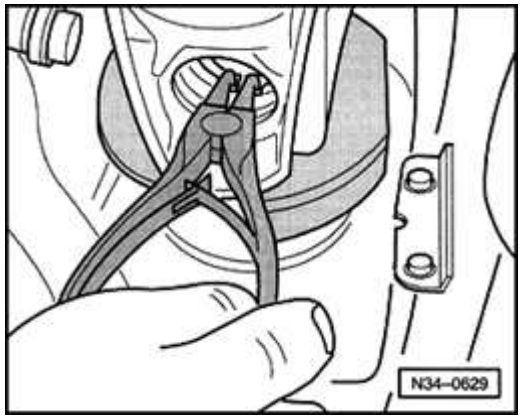
- Remove driveshaft -1- from transmission and rest it on heat shield -2-.
- Secure driveshaft to fuel line bracket -3- using wire (arrows).
- Place VAG1306 drip tray underneath and drain transmission oil.
- Place VAG1306 drip tray underneath end cover.

Note:

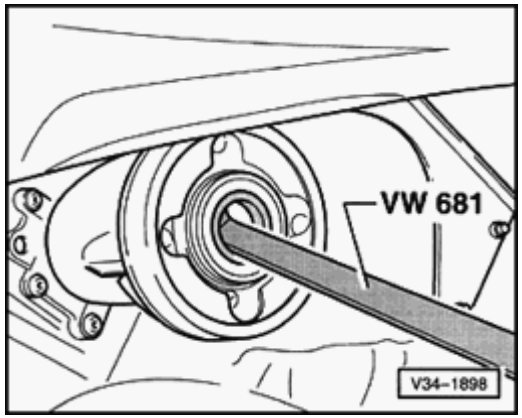


Oil will run out when removing cap -B-

- Remove circlip -A-.
- Screw M8 bolt into thread of cap -B-.
- Pull out cap -B- using bolt.



- Expand circlip and pull out drive flange.

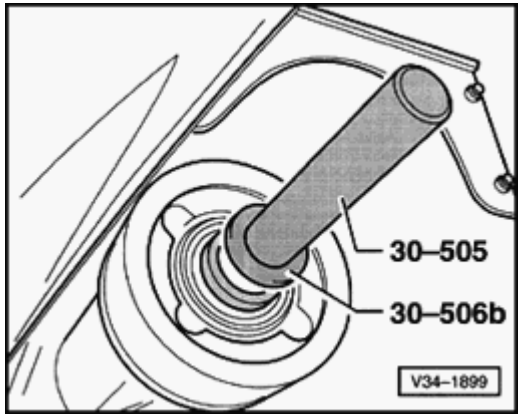


- Remove drive flange oil seal using VW681 extractor lever.

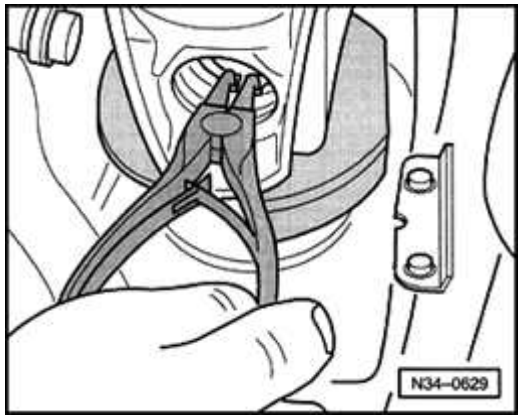
Installing

- Fill space between sealing lip and dust lip with gear oil.

- Lightly oil outer circumference of seal.



- Drive in drive flange seal 2 mm (0.079 in.) below outer housing surface, without canting.
- Install drive flange.



- While inserting drive flange, install circlip at same time.

The circlip must be seated in the base of the groove.

- Replace O-ring for cap.
- Install cap and secure in position.
- Install driveshaft ⇒ Page 39-71 .

- Top off and check transmission oil level ⇒ Page 34-38 .

- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component		Tightening torque
Driveshaft to transmission		55 Nm (41 ft lb)
Heat shield for driveshaft to Torsen differential cover		25 Nm (18 ft lb)

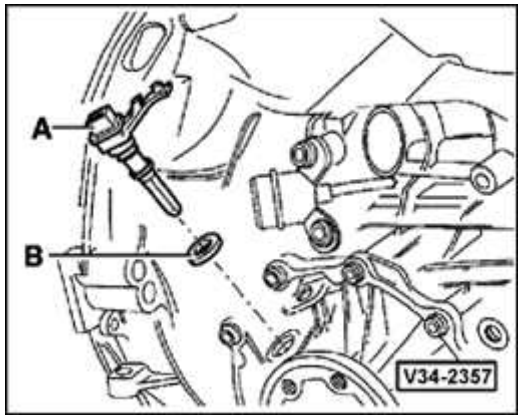
Speedometer Vehicle Speed Sensor (VSS) -G22- and sensor drive gear, removing and installing

- Transmission installed

- Observe general repair instructions ⇒ Page 00-10 .

Vehicle Speed Sensor (VSS) -G22-, removing and installing

Removing



- Disconnect harness connector at Vehicle Speed Sensor (VSS) -A-.
- Press retaining clip down, turn sensor sideways and remove upward.

Installing

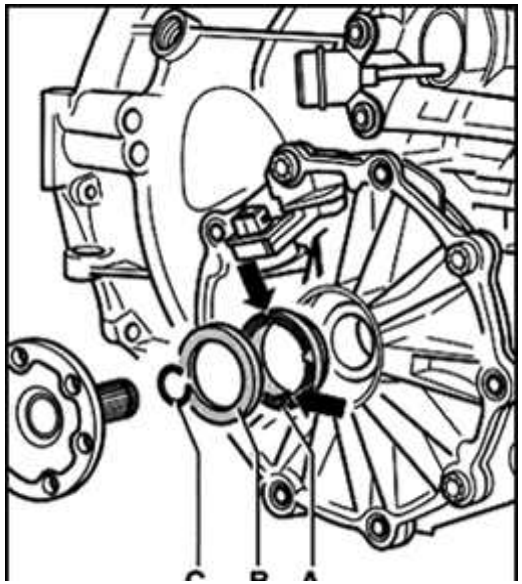
- Replace O-ring -B-.
- Install sensor and lock into place.
- Handle sensor carefully. If damaged, speed readings may not be correct.

Speedometer drive gear, removing and installing

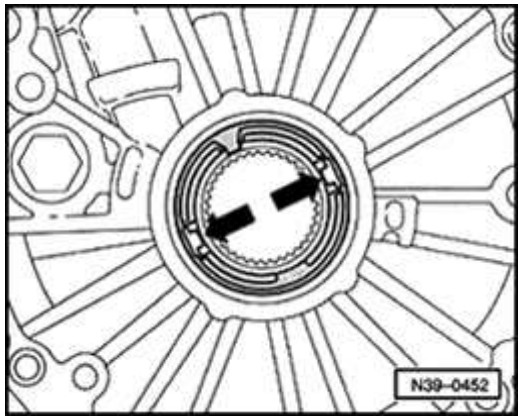
Special tools and equipment

- VW195 arbor
- VW295 needle bearing drift
- VW681 extractor lever
- VAG1306 drip tray

Removing



- Remove left drive flange and seal -B- ⇒ Page 39-1 .
- Remove Vehicle Speed Sensor (VSS) ⇒ Page 39-7 .



- Press retaining clips in direction of arrows using screwdriver.
- Remove drive gear by prying out, alternating between sides.

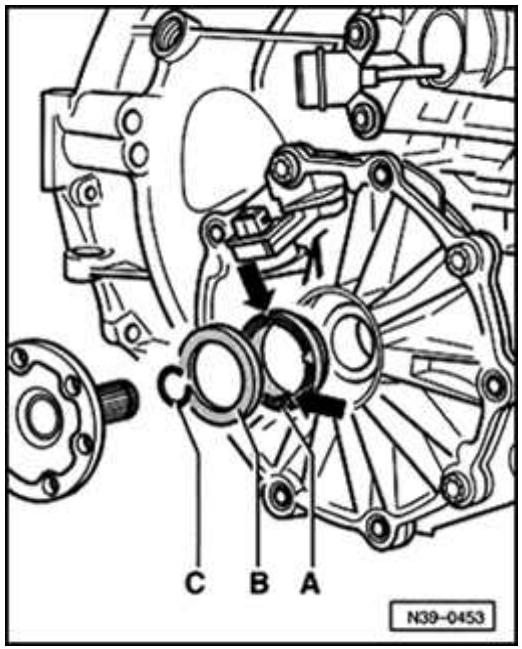
Installing

Installation is the reverse order of removal, note the following:

Note:

Carefully install drive gear onto differential without canting. Do not use force: the drive gear can break easily.

Installation position:



➢ The drive peg of the drive gear -A- faces seal -B- and locks into groove in the differential.

The retaining clips (arrows) lock in the circumferential groove in the differential.

- Always replace seal -B- and circlip -C- ⇒ Page 39-3 .
- Drive in drive flange using VW295 needle bearing drift.
- Top up and check transmission fluid ⇒ Page 34-36 .

Tightening torques

Component		Tightening torque
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	77 Nm (57 ft lb)
Heat shields over drive axles to transmission		

	23 (17 ft lb)

Differential, removing and installing

Special tools and equipment

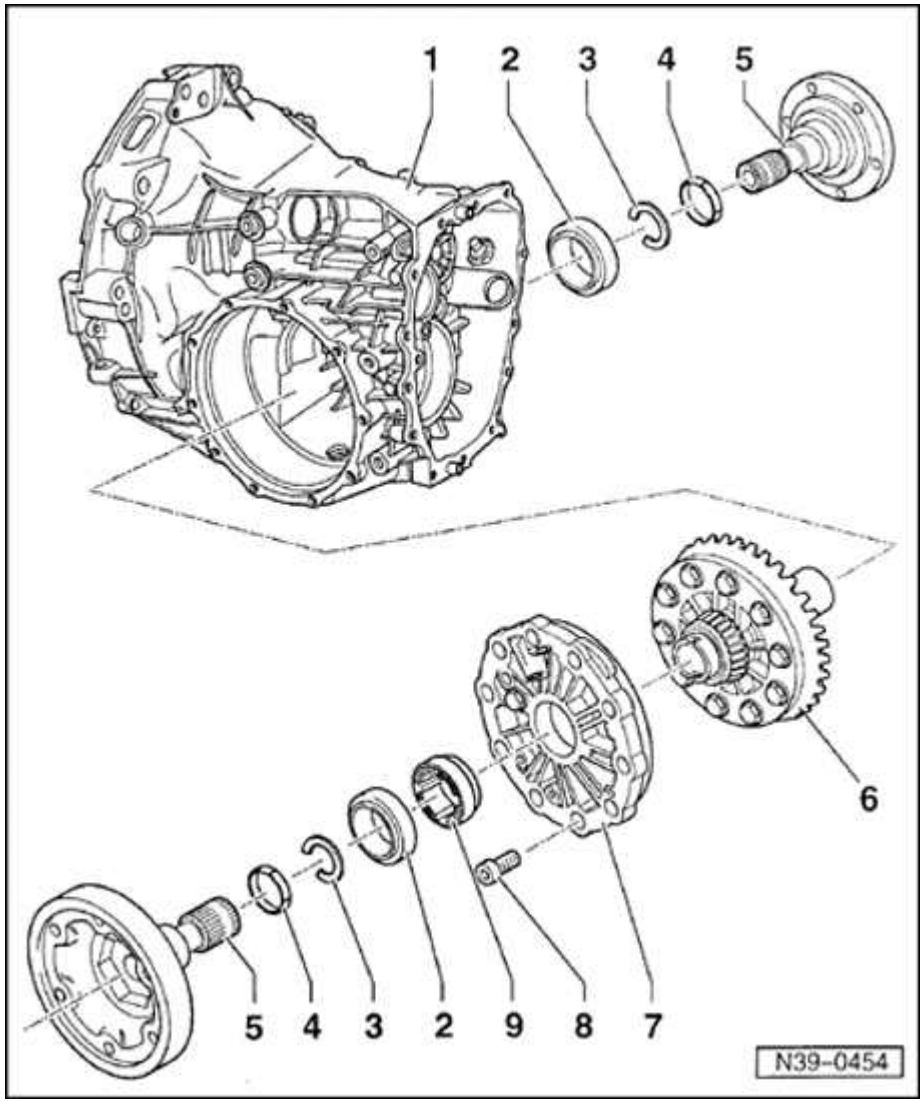
- VW771 slide hammer - complete set
- 3257 Puller
- Kukko 21/3 extractor

Notes:

- *Removal and installation is also possible with transmission installed.*
- *The differential can be removed and installed without disassembling shift mechanism, input shaft, pinion shaft or transmission cover. The above components have to be disassembled if the differential needs to be adjusted.*
- *Flanges with and without polygon bearings are used. Application ⇒ Page 00-3 .*
- *Polygon bearings can only be replaced together with drive flange.*

- *Look for visible damage to polygon bearings.*
- *The rough operation of the polygon bearing with the drive flange not installed is not an indication that the bearings are malfunctioning. An acoustic check can only be carried out while installed.*
- *A spacer ring is installed between the polygon bearing and differential pinion for drive flanges with a spline diameter of 30 mm ⇒ Page 39-14 , ⇒ Fig. 3 and ⇒ Fig. 4 .*
- *Adjustments are required when replacing components marked with 1): ⇒ Page 39-33 , list of adjustments*

39-11



1 - Transmission housing 1)

2 - Seal

- Always replace ⇒ Page 39-1

3 - Circlip

- Always replace
- Removing and installing ⇒ Fig. 1

4 - Spacer ring

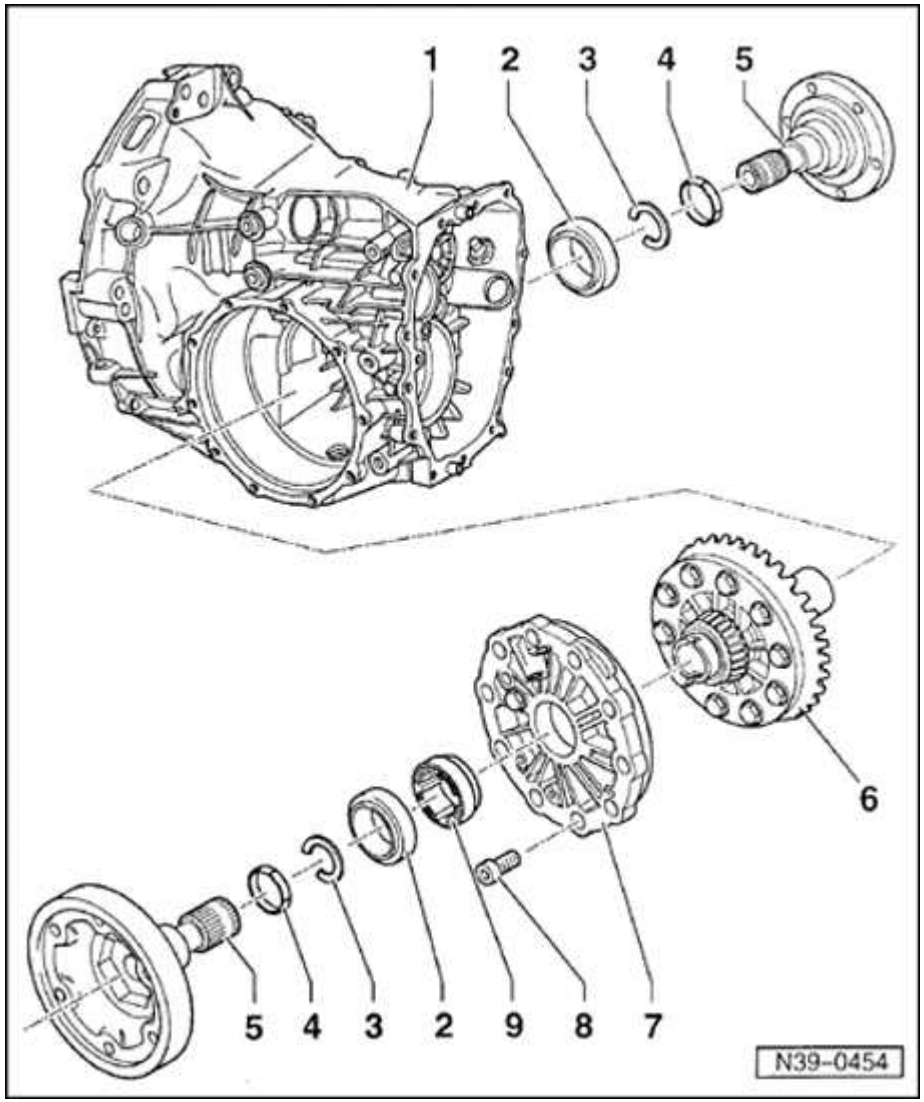
- Only for drive flange with polygon bearings and splines with 30 mm diameter ⇒ Page 00-3
- Removing ⇒ Fig. 2
- Installing ⇒ Fig. 3

5 - Drive flange

- Removing and installing ⇒ Page 39-1
- Drive flange with polygon bearing assembly ⇒ Fig. 4

6 - Differential with ring gear 1)

- Can be installed without removal of transmission
- Disassembling and assembling ⇒ Page 39-15



7 - Cover for final drive 1)

- Coat sealing surfaces with thin layer of sealant AMV 188 001 02

8 - Torx® bolt

- 25 Nm (18 ft lb)

9 - Drive gear for Vehicle Speed Sensor (VSS)

- Removing and installing ⇒ Page 39-8
- Carefully install onto differential without canting. Do not use force: drive gear can break easily.

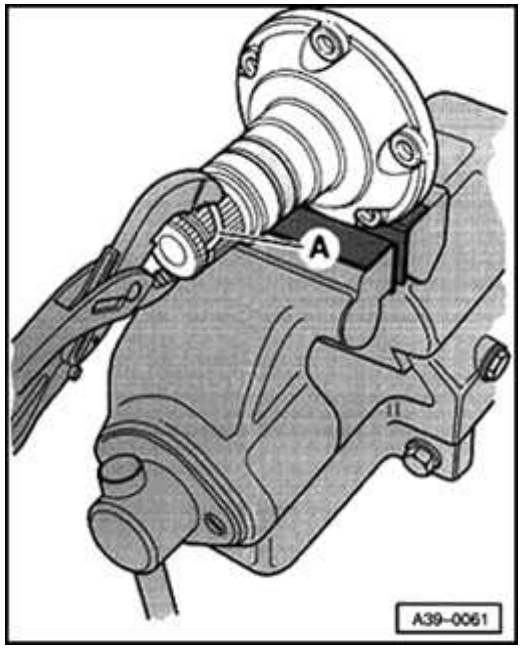


Fig. 1 Removing and installing circlip

- Clamp drive flange into vise using protective jaws. Press circlip out of groove in drive flange by pressing in new circlip -A-.

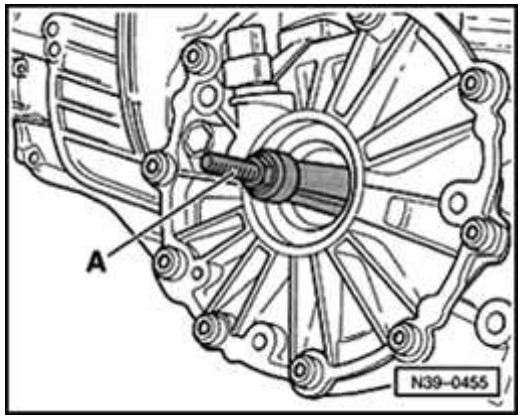


Fig. 2 Removing spacer ring

A - Kukko 21/3 extractor 18.5-23.5 mm

- If spacer ring is tight, remove using VW771 slide hammer-complete set.

39-14

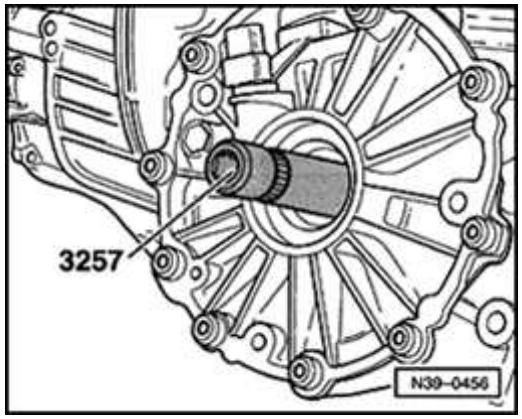


Fig. 3 Installing spacer ring

- Press in spacer ring to stop without canting.

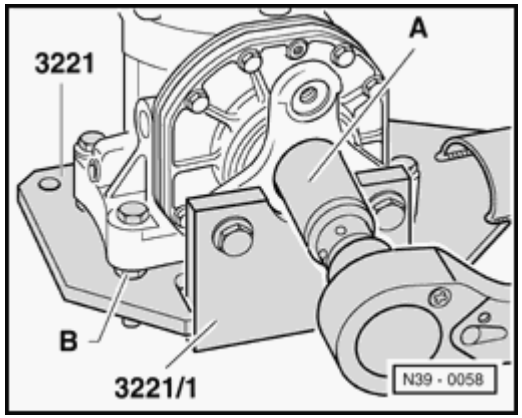


Fig. 4 Drive flange with polygon bearing assembly

1 - Drive flange

2 - Needle bearing (polygon bearing)

3 - Spacer ring

4 - Circlip

5 - Spacer ring (is installed additionally if spline diameter is 30 mm)

Note:

Needle bearings (polygon bearings) do not turn easily with drive flange removed. This does not indicate a bearing is malfunctioning.

Speedometer Vehicle Speed Sensor (VSS), removing and installing

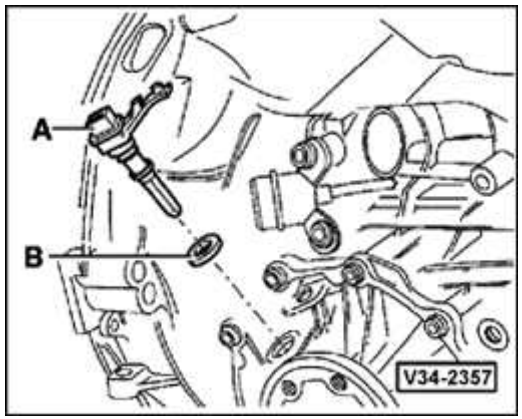
- Transmission installed

- Observe general repair instructions ⇒ Page 00-14 .

CAUTION!

Handle sensor carefully. If damaged it may not indicate speed accurately.

Removing



- Disconnect harness connector from Speedometer Vehicle Speed Sensor (VSS) -A-.
- Press retaining clip down, turn sensor sideways and remove upward.

Installing

- Replace seal -B-.
- Install sensor and lock in place.

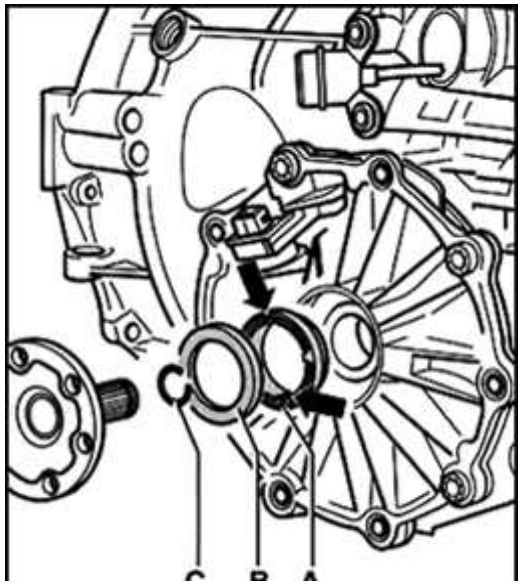
39-14

Speedometer drive gear, removing and installing

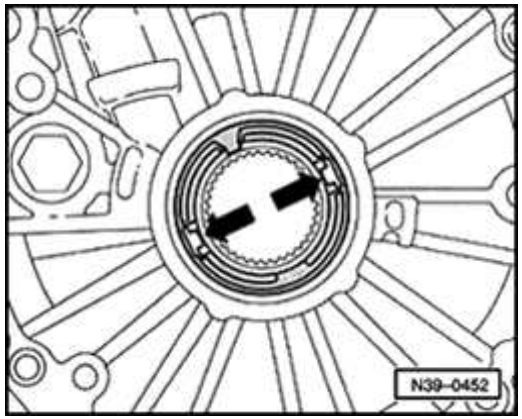
Special tools and equipment

- VW195 arbor
- VW295 needle bearing drift
- VW681 extractor lever
- VAG1306 drip tray

Removing



- Remove left drive flange and seal -B- ⇒ drive flange seal, replacing, ⇒ Page 39-1 .
- Remove speedometer vehicle speed sensor ⇒ Page 39-13 .



- Press retaining clips in direction of arrows using screwdriver.
- Carefully remove drive gear by prying out out, alternating between sides.

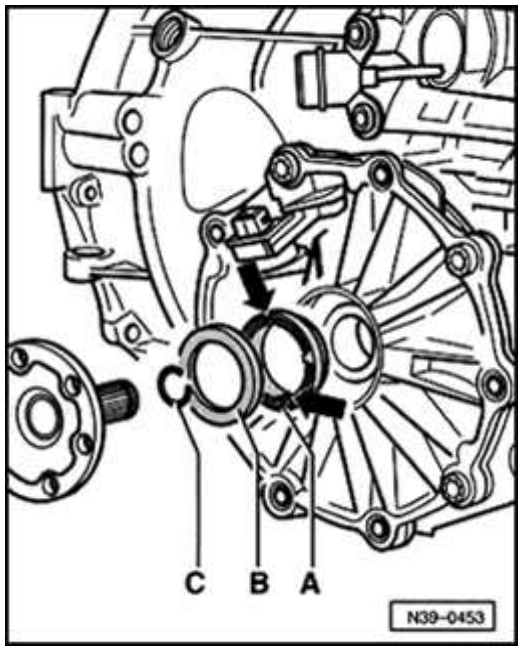
Installing

Installation is the reverse of removal, note the following:

CAUTION!

Install the drive gear carefully onto the differential, without canting. Do not use force, the drive gear can break easily.

Installation position:



➢ The drive peg of the drive gear -A- faces seal -B- and locates in the groove of the differential.

Retaining clips (arrows) locate in circumferential groove in differential.

- Always replace seal -B- and circlip -C- ⇒ Page 39-3 .
- Install drive flange using VW295 needle bearing drift.
- Top off and check transmission oil level ⇒ Page 34-38 .

Tightening torques

Component		Tightening torque
Driveshaft to drive flange	M 8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)
Heat shields over drive axles on transmission		23 Nm (17 ft lb)

Differential, disassembling and assembling

Special tools and equipment

- VW295 needle bearing drift
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW447H thrust pad
- VW447I thrust pad
- VW472/1 pressure piece
- VW511 thrust pad
- 30-11 thrust pad

- 30-205 thrust pad
- 40-21 sleeve

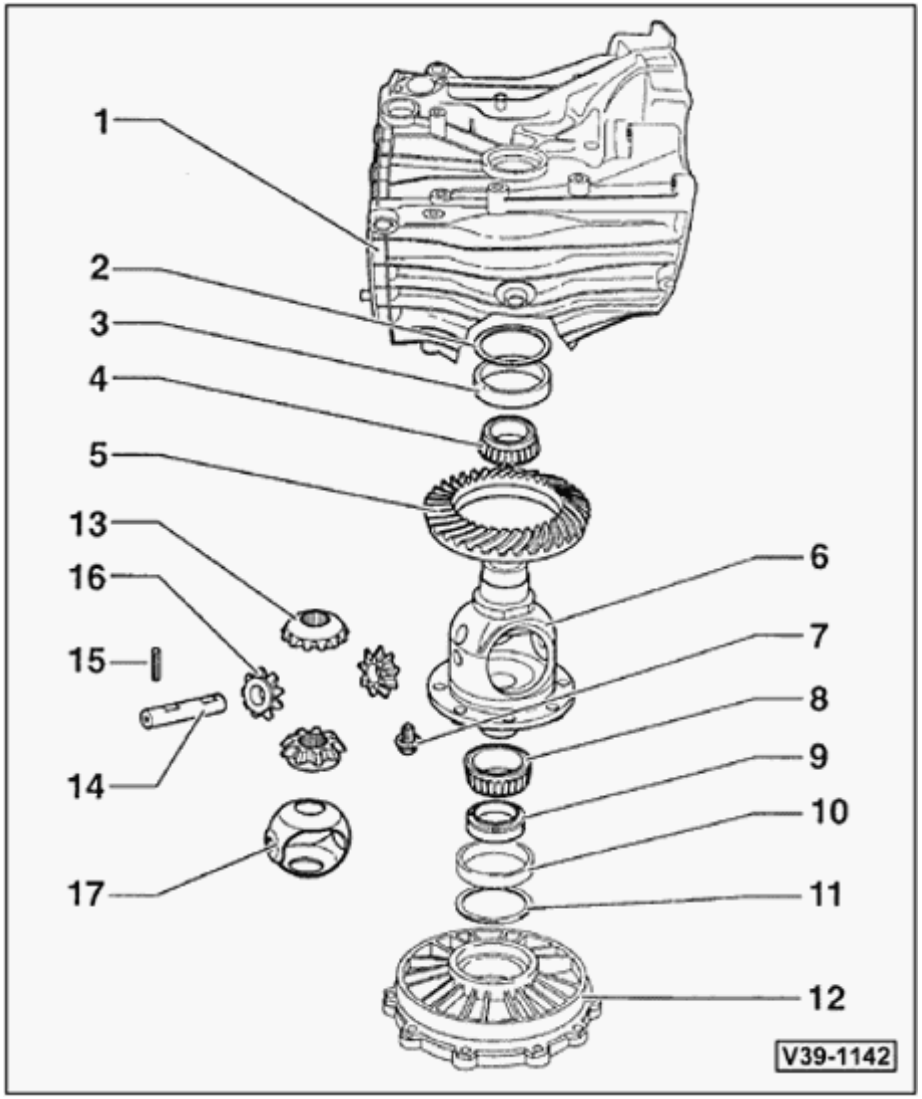
39-16

- 40-105 thrust piece
- 3138 drift
- 3144 press support
- 3296 tube
- Sealant AMV 188 001 02
- Kukko 20/10 two-arm puller or Kukko 44/2 puller
- Kukko 204/2 two-arm puller

Notes:

- *Removing and installing differential* ⇒ *Page 39-10* .
- *Replace both tapered roller bearings together.*
- *Adjustments are required when replacing components marked with 1)* ⇒ *Page 39-33* , *list of adjustments*

39-17



1 - Transmission housing 1)

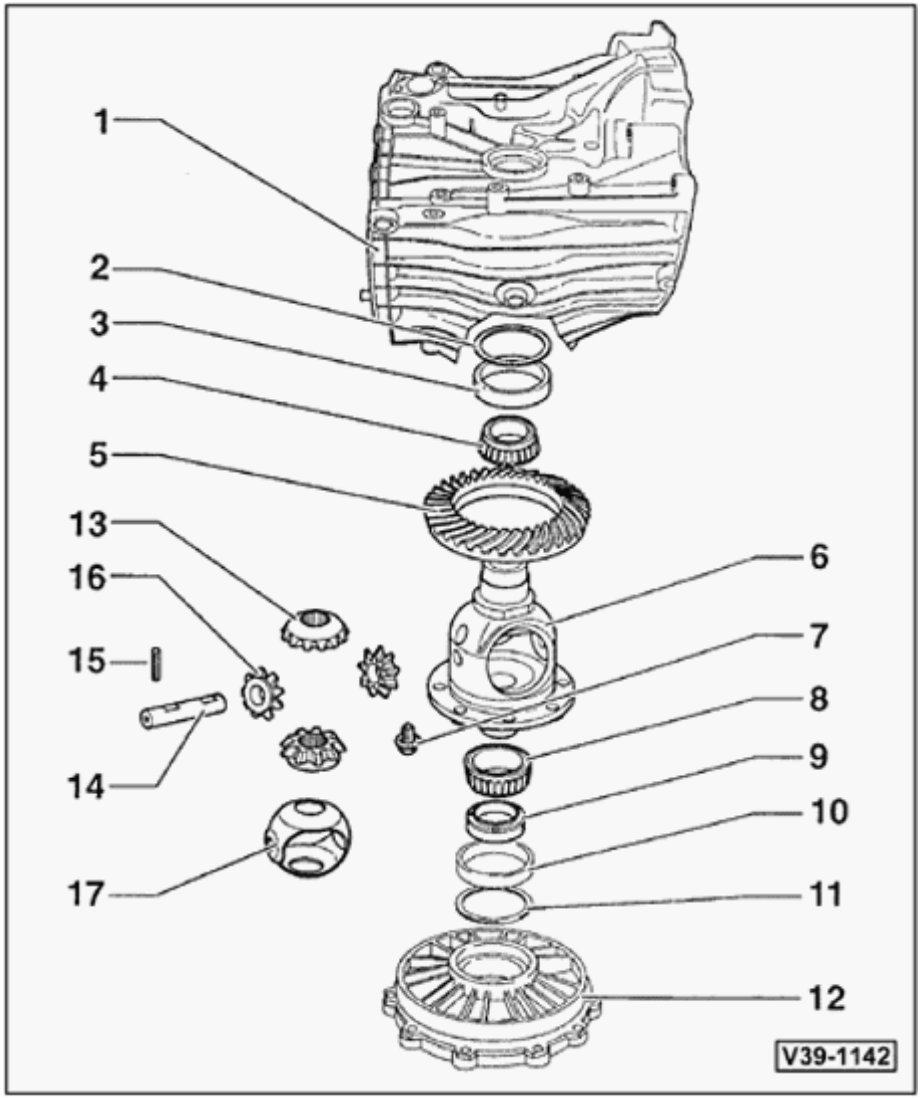
2 - Shim S2

- Note thickness
- List of adjustments ⇒ Page 39-33

3 - Right tapered roller bearing outer race 1)

- Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ Page 00-3
- Driving out for transmission with polygon bearing ⇒ Fig. 1 , ⇒ Page 39-22
- Driving out for transmission without polygon bearing ⇒ Fig. 2 , ⇒ Page 39-22
- Driving in for transmission with polygon bearing ⇒ Fig. 3 , ⇒ Page 39-23
- Driving in for transmission without polygon bearing using VW295 needle bearing drift and 30-205 thrust pad

39-18



4 - Right tapered roller bearing inner race 1)

- Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ Page 00-3
- Pull off using 3296 tube ⇒ Fig. 4
- Pressing on for transmission with polygon bearing ⇒ Fig. 5 , ⇒ Page 39-24
- Pressing on for transmission without polygon bearing using 40-21 sleeve

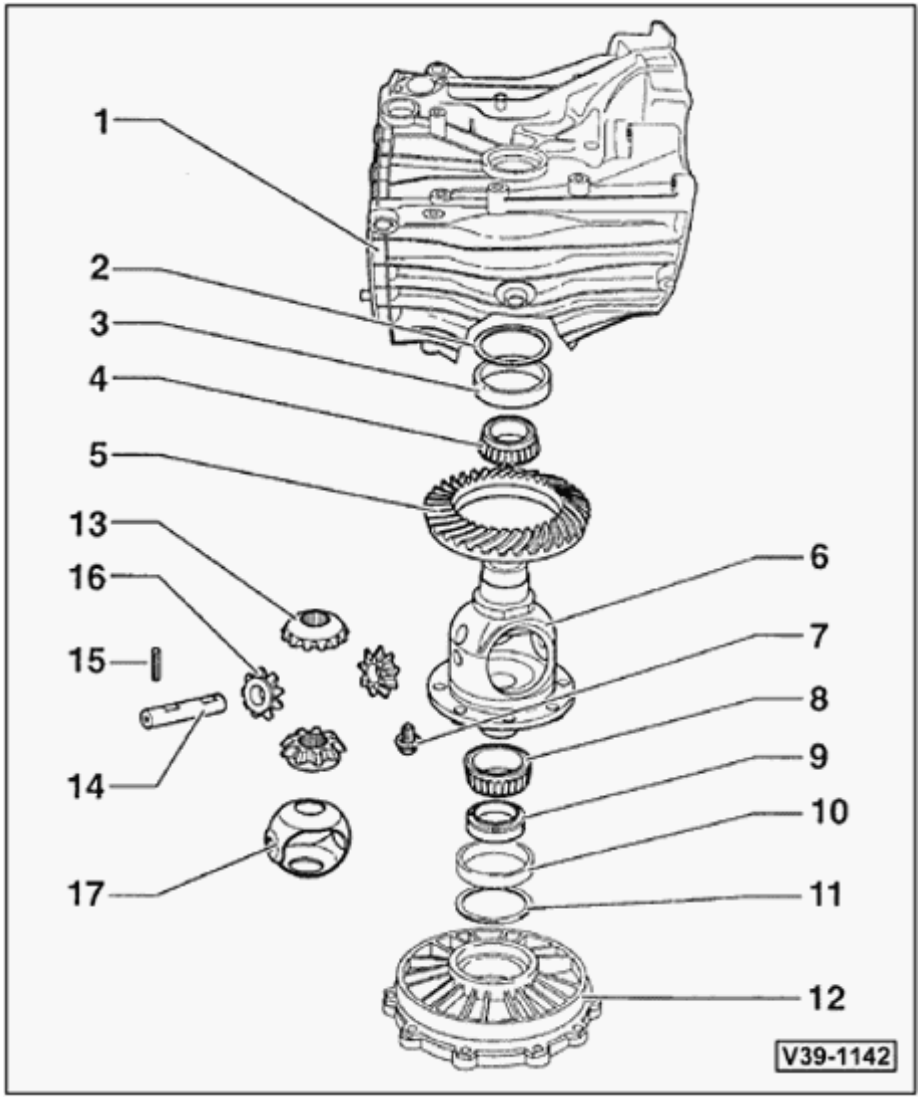
5 - Ring gear 1)

- Is matched to pinion shaft (gear set)
- Allocate according to transmission code letters using parts catalog microfiche ⇒ Page 00-3
- Remove from transmission housing using drift ⇒ Fig. 10
- Installing on differential housing ⇒ Fig. 11

6 - Differential housing 1)

- Allocate according to transmission code letters using parts catalog ⇒ Page 00-3

39-19



7 - Bolt

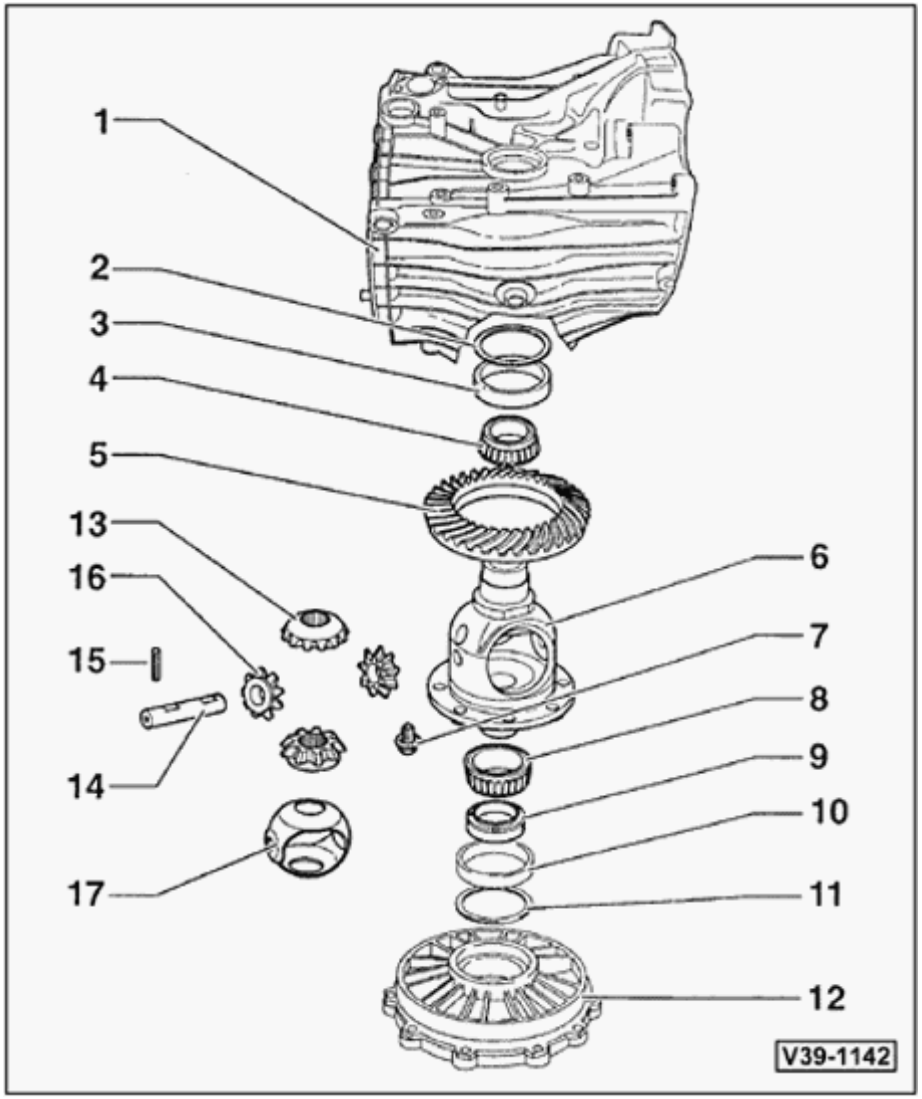
- Always replace
- Tighten to 60 Nm (44 ft lb) and then tighten another 45°
- Lightly tighten bolts then tighten diagonally to correct torque

8 - Left tapered roller bearing inner race 1)

- Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ Page 00-3
- Pulling off ⇒ Fig. 6
- Driving in for transmission with polygon bearing ⇒ Fig. 7 , ⇒ Page 39-25
- Pressing on for transmission without polygon bearing using 40-21 sleeve

9 - Drive gear for Vehicle Speed Sensor (VSS)

- Removing and installing ⇒ Page 39-7
- Carefully install onto differential without canting. Do not use force: the drive gear can break easily.



10 - Left tapered roller bearing outer race 1)

- Left and right tapered roller bearings are identical (not for transmission without polygon bearing) ⇒ Page 00-3
- Driving out ⇒ Fig. 8
- Driving in for transmission with polygon bearing ⇒ Fig. 9 , ⇒ Page 39-26
- Driving in for transmission without polygon bearing using VW295 needle bearing drift and 511-205 thrust pad

11 - Adjustment shim S1

- Note thickness
- List of adjustments ⇒ Page 39-33

12 - Final drive cover 1)

- Coat sealing surfaces with a thin layer of sealant AMV 188 001 02.

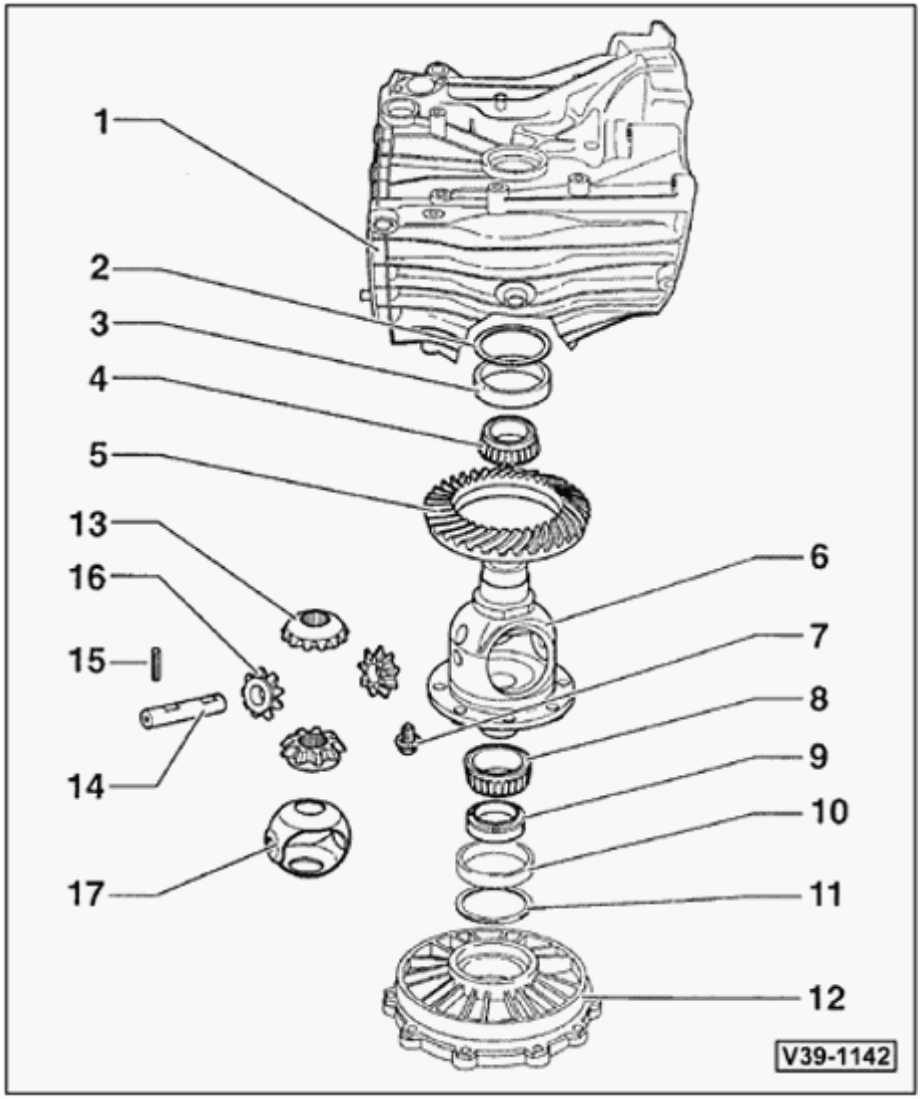
13 - Large differential bevel gear

- Installing ⇒ Fig. 12

14 - Differential bevel gear shaft

- Drive out using drift after removing roll pin

39-21



15 - Roll pin

- For securing differential bevel gear shaft
- Version with annular groove: Removing and installing ⇒ Fig. 13
- Version without annular groove: drive out using drift

16 - Small differential bevel gear

- Installing ⇒ Fig. 12

17 - Thrust washer assembly

- Lubricate with transmission fluid before installing

39-22

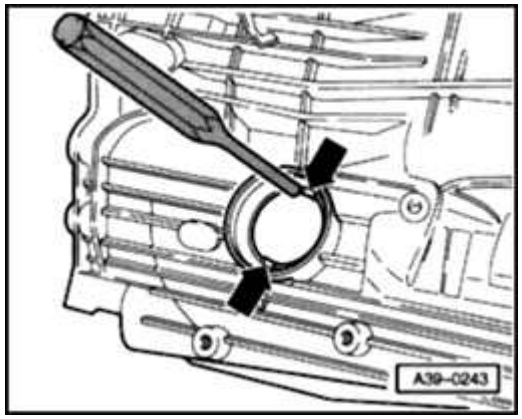


Fig. 1 Removing right tapered roller bearing outer race from transmission housing (for transmissions with polygon bearing)

- To drive out, place punch pin alternately on cut-outs (arrows) on bearing seat.

Note:

Adjustment shims are damaged when outer race is driven out. Replace adjustment shims.

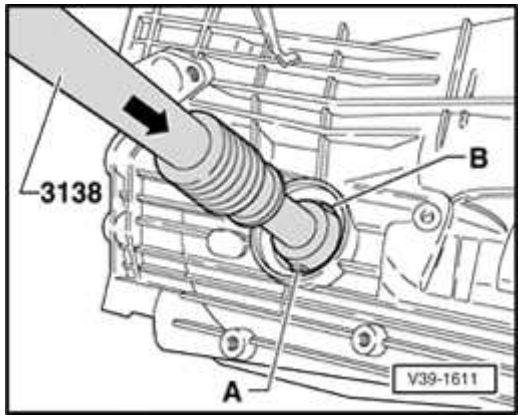


Fig. 2 Removing right tapered roller bearing outer race from transmission housing for transmissions without polygon bearing

- Turn webs -A- and -B- out until they sit on outer race within recess in transmission.
- After removing, check adjustment shims for damage.

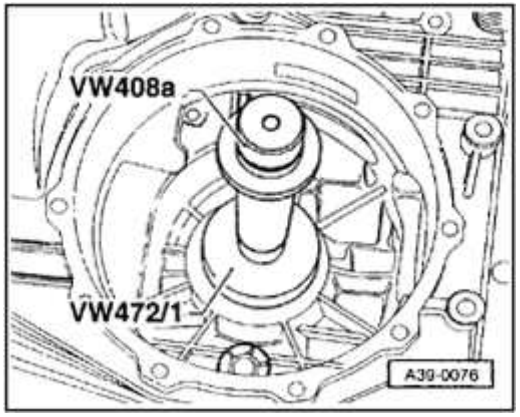


Fig. 3 Installing right tapered roller bearing outer race in transmission housing

- Insert VW472/1 pressure piece together with cone in outer race.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use 30-205 thrust pad and VW295 needle bearing drift.

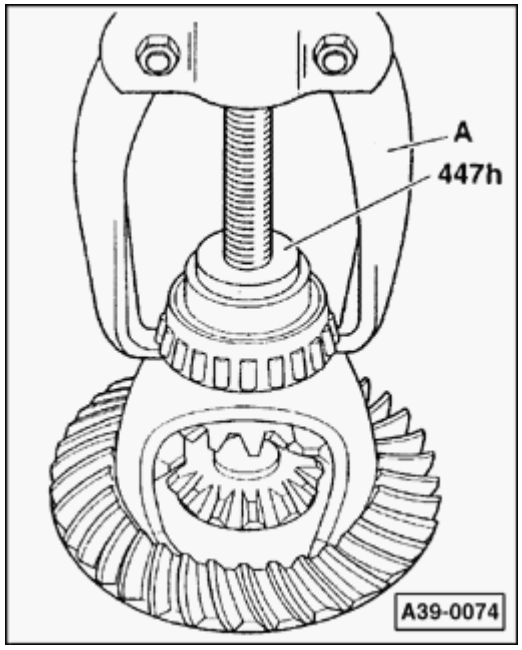


Fig. 4 Pulling off right tapered roller bearing inner race

A - Kukko 20/10 two-arm puller or Kukko 44/2 puller

Notes:

- *On a puller with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and the puller.*
- *For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use 40-105 thrust piece.*
- *The differential has a notch under the bearing seat to install puller -A-.*

39-24

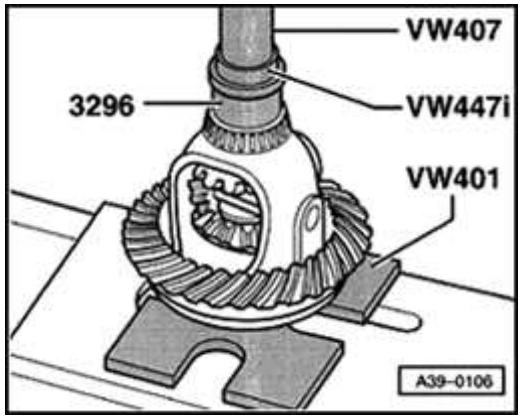


Fig. 5 Pressing on right tapered roller bearing inner race

WARNING!

Wear protective gloves!

- Heat inner race to approximately 100 ° C (212 ° F), position and install.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use 40-21 sleeve.

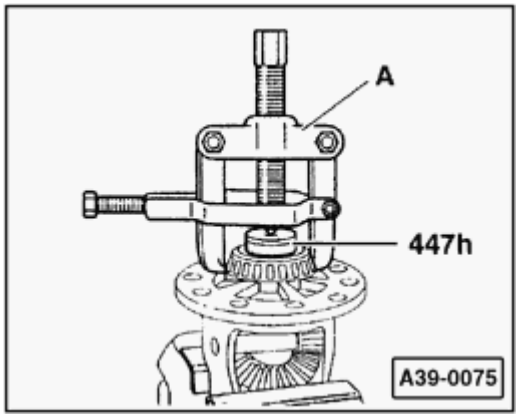


Fig. 6 Pulling off left tapered roller bearing inner race

A - Kukko 204/2 two-arm puller

Notes:

- *On a puller with a small spindle diameter, 30-11 must be placed between the 447H pressure washer and the puller.*
- *For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use 40-105 thrust piece.*
- *The differential has a notch under the bearing seat to install puller -A-.*

39-25

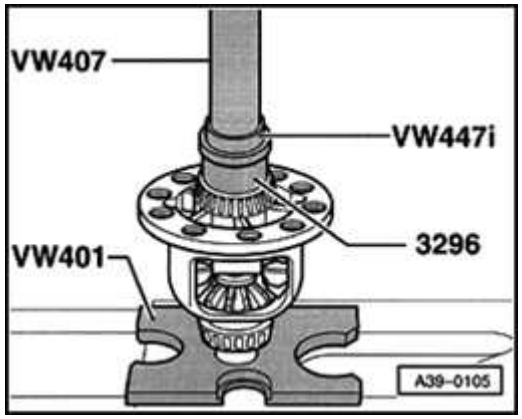


Fig. 7 Installing left tapered roller bearing inner race

WARNING!

Wear protective gloves!

- Heat inner race to approximately 100 ° C (212 ° F), position and install.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use 40-21 sleeve.

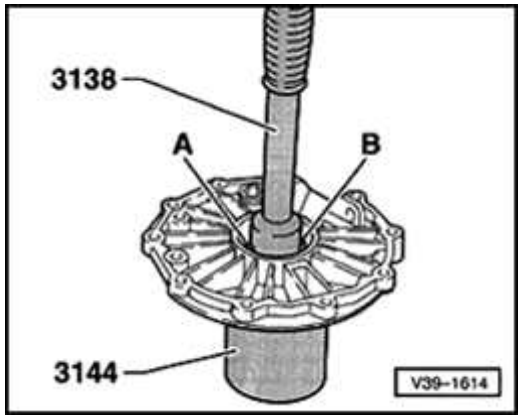


Fig. 8 Driving out left tapered roller bearing outer race from cover

- Turn webs -A- and -B- out until they sit on outer race within recess in transmission.
- After removing, check adjustment shims for damage.

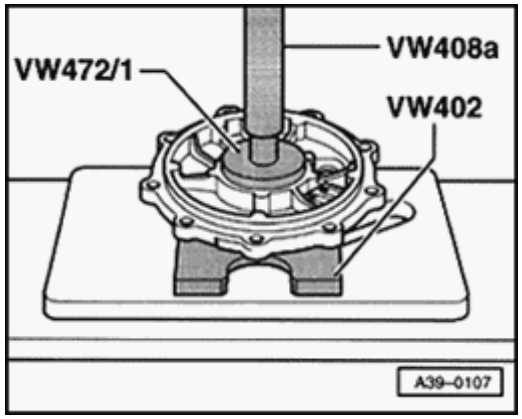


Fig. 9 Driving in left tapered roller bearing outer race into cover

- Insert VW472/1 pressure piece together with cone in outer race.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use VW511 thrust pad and VW295 needle bearing drift.

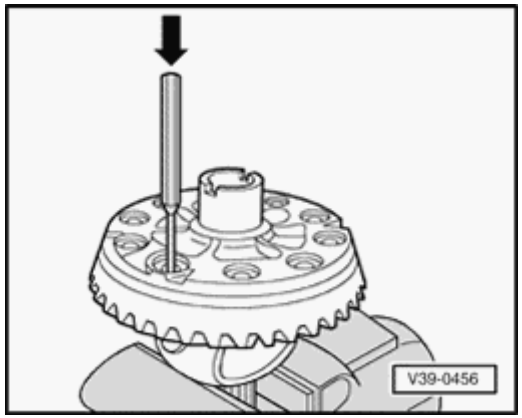


Fig. 10 Driving out ring gear from housing

39-27

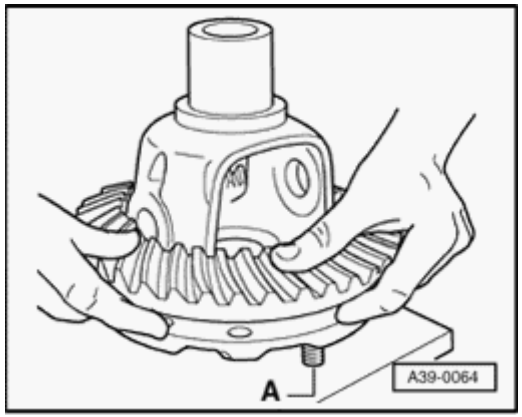


Fig. 11 Installing ring gear

WARNING!

Wear protective gloves!

- When installing ring gear guide with centering pins -A- (local manufacture).
- Heat ring gear to approximately 100 ° C (212 ° F) and install.
- Before installing bolts, allow ring gear to cool a bit. Then tighten to specified torque.

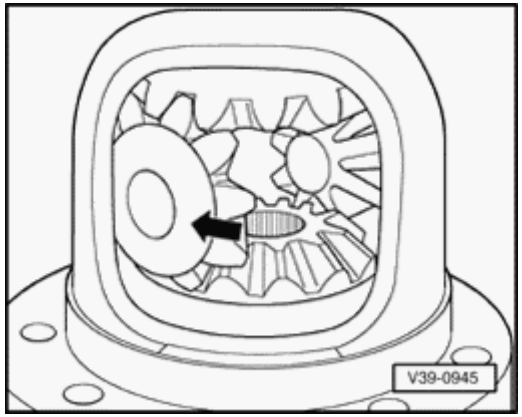


Fig. 12 Installing differential bevel gears

- Lubricate one-piece thrust washer with transmission oil before installing.
- Install large differential bevel gears.
- Install small differential bevel gears at 180 ° from their final position and rotate into place (arrow).
- Drive in differential bevel gear shaft to final position and secure.

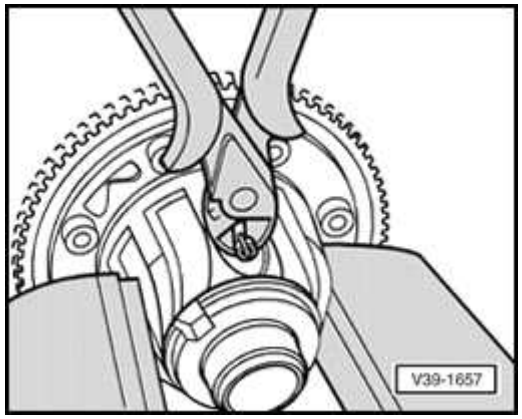


Fig. 13 Removing and installing roll pin

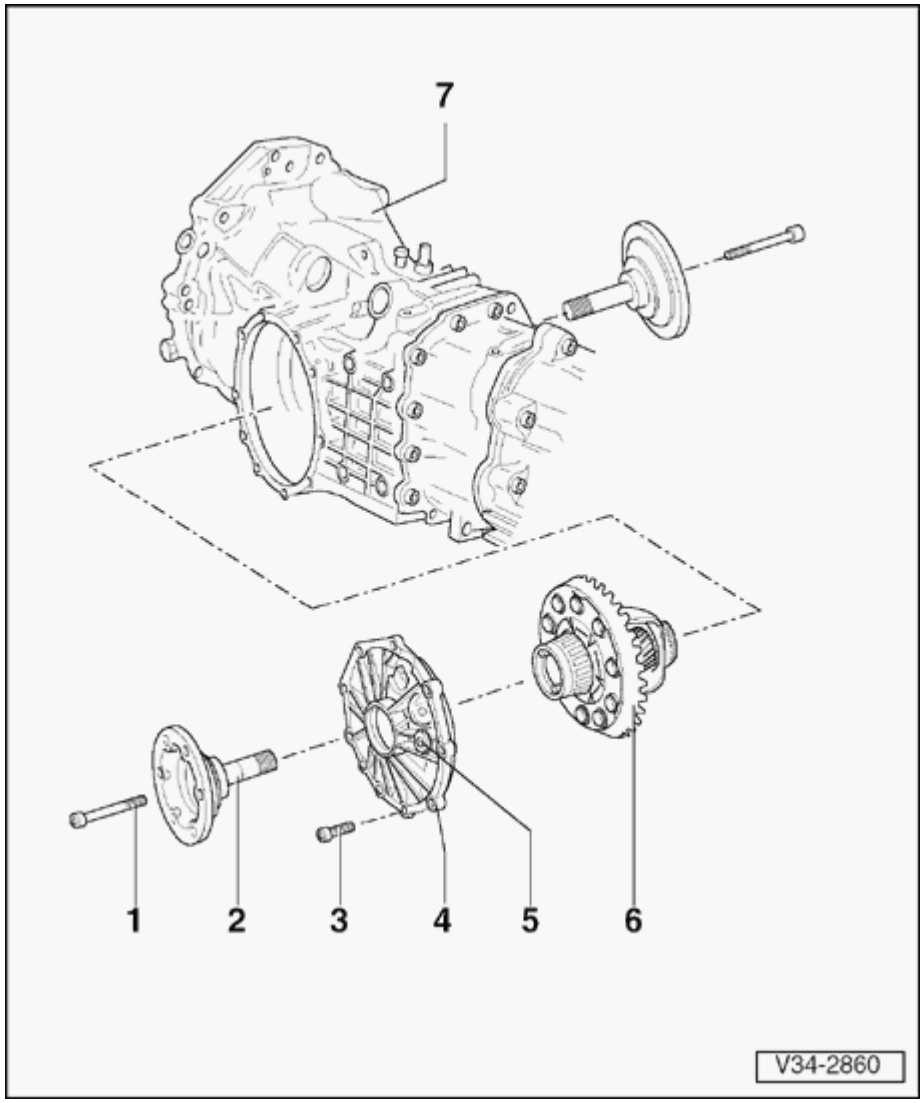
Removing

- Remove roll pin with annular groover using diagonal cutting pliers.
- Remove roll pin without annular groove using punch.

Installing

- Install roll pin to stop.

39-15



Differential, removing and installing

Note:

Removing and installing is also possible with transmission installed in vehicle.

1 - Bolt, 10 Nm + 1/4 turn (90 °) further

2 - Drive flange

- When removing, secure with a drift to prevent it turning

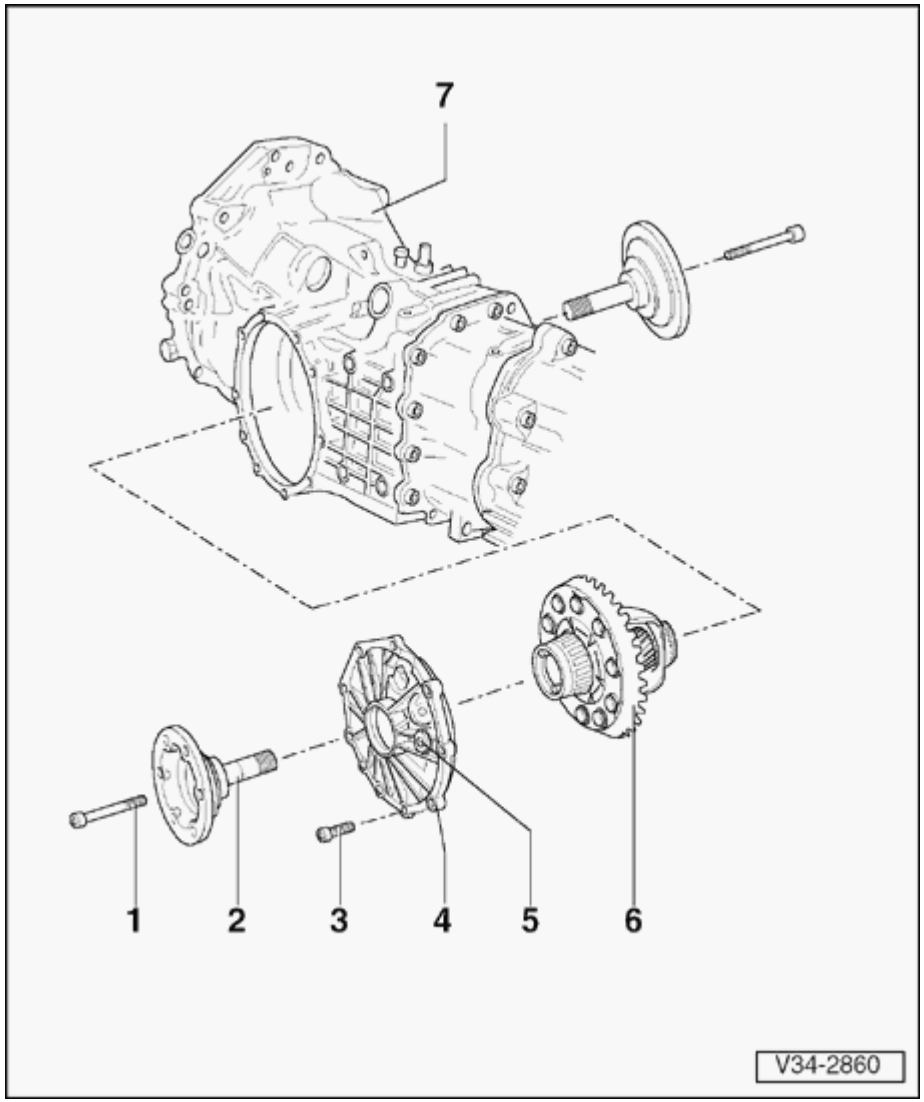
3 - Bolt, 25 Nm

- Qty. 10

4 - Cover for final drive

- Removing and installing drive wheel for speedometer sender -G22 ⇒ Page 39-4
- If replaced: adjust ring gear ⇒ Page 39-52

39-16



5 - Oil filler plug, 40 Nm

- Checking oil level in transmission ⇒ Page 34-39

6 - Differential

- Disassembling and assembling ⇒ Page 39-17
- If replaced: adjust ring gear ⇒ Page 39-52

7 - Transmission housing

- Servicing ⇒ Page 34-127

Differential, removing and installing

Special tools and equipment

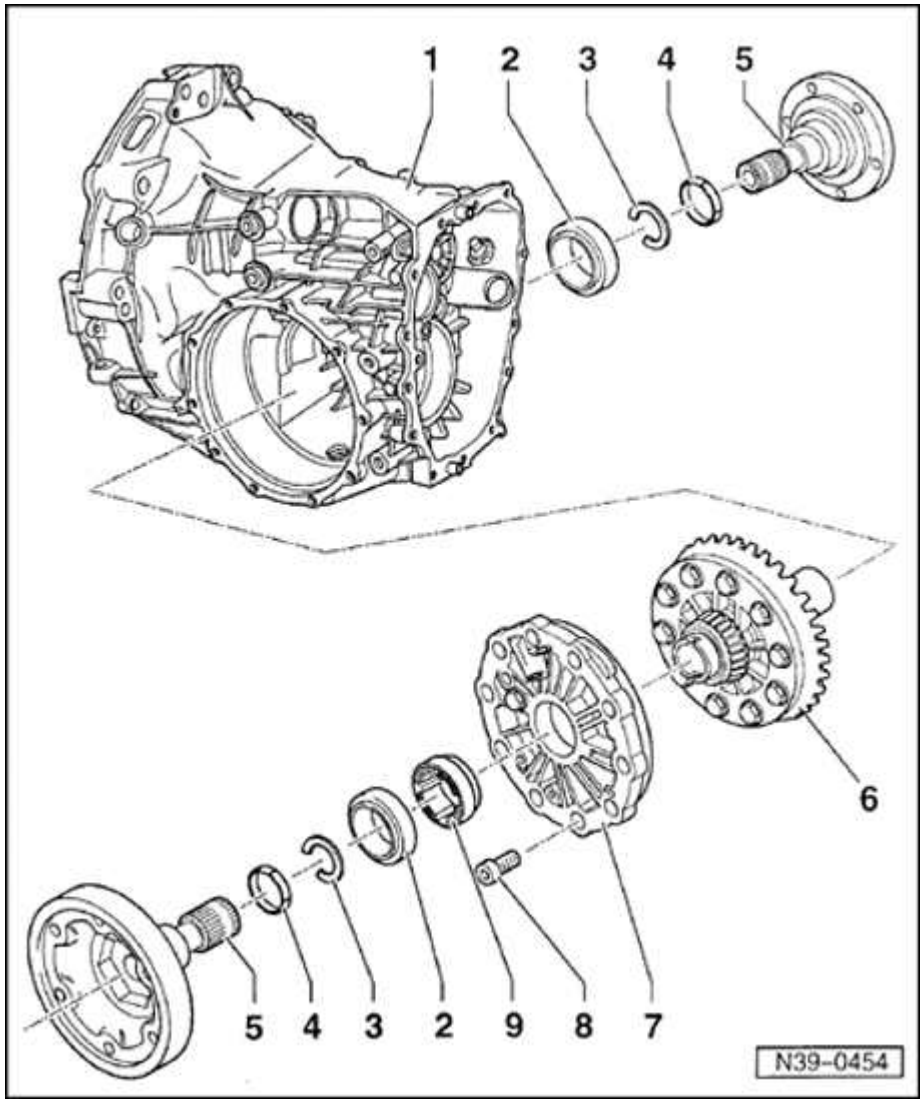
- VW771 slide hammer-complete set
- 3257 plug insert 27 mm
- 21/3 Kukko extractor

Notes:

- *Removing and installing the differential is possible with the transmission installed.*
- *The differential can be removed and installed without disassembly of the shift mechanism, drive axle, pinion shaft, and cover. Disassembly of the above mentioned parts is necessary, if the differential needs to be adjusted.*
- *Transmission code CXF: drive flanges are installed without polygon bearings.*
- *Polygon bearing can be replaced only with the drive flange.*

- *Check for visible damage to polygon bearing.*
- *The rough surface of the polygon bearing (with drive flange not installed) is not an indication that the bearing is defective. An acoustic test is possible only when installed.*
- *For drive flanges with a spline diameter of 30 mm (1.181 in) a spacer ring is installed between polygon bearing and tapered bearing ⇒ Page 39-20 , ⇒ Fig. 4 , item -5-.*
- *When replacing the parts identified with1), adjustment work is required ⇒ List of adjustments, ⇒ Page 39-39 .*

39-17



1 - Transmission housing1)

2 - Seal

- Always replace ⇒ Page 39-1

3 - Circlip

- Always replace
- Removing and installing ⇒ Fig. 1

4 - Spacer ring

- Only installed on drive axles with polygon seals and spline diameter of 30 mm (1.181 in)
- Removing ⇒ Fig. 2
- Installing ⇒ Fig. 3

5 - Drive flange

- Removing and installing ⇒ Page 39-1
- Assembly ⇒ Fig. 4

6 - Differential with ring gear1)

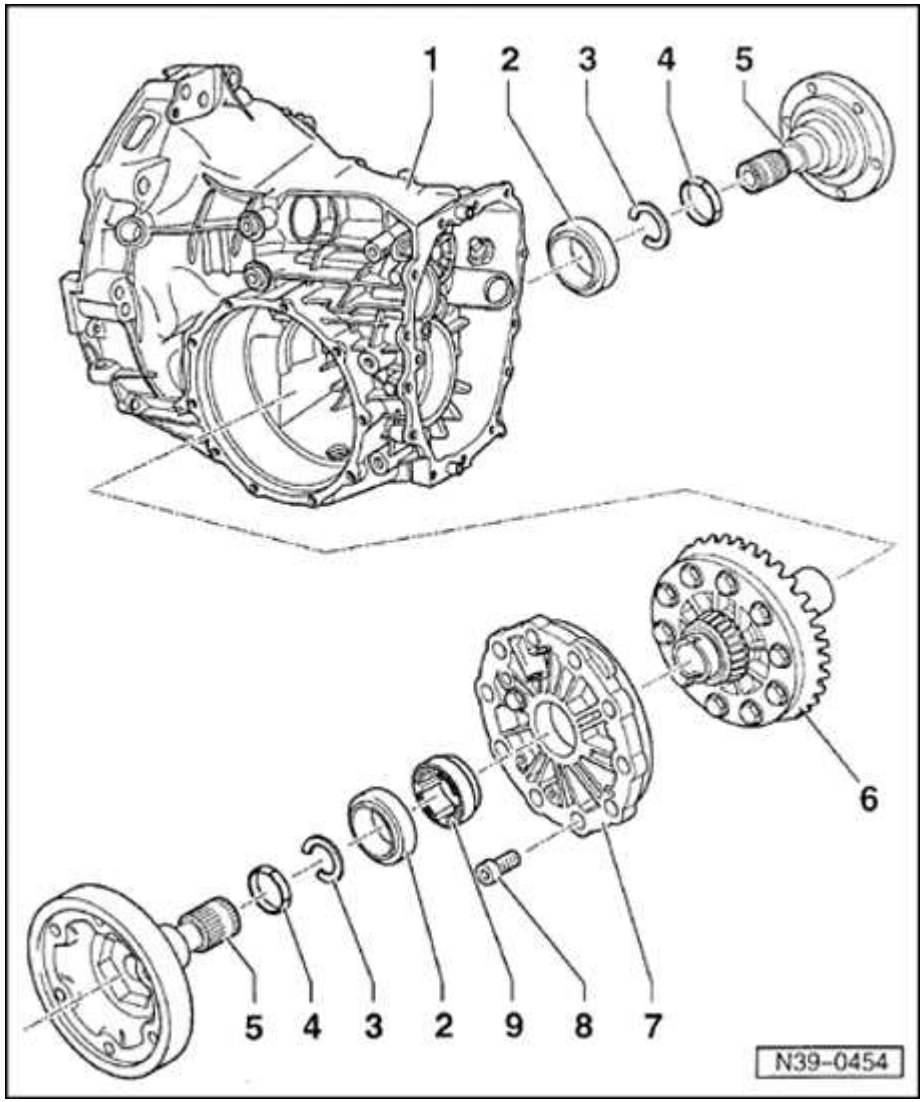
- Disassembling and assembling ⇒ Page 39-21

7 - Cover for final drive1)

8 - Torx® bolt

- 25 Nm (18 ft lb)

39-18



9 - Speedometer drive gear

- Removing and installing ⇒ Page 39-14

CAUTION!

Install the drive gear carefully onto the differential without canting. Do not use force, the drive gear can break easily.

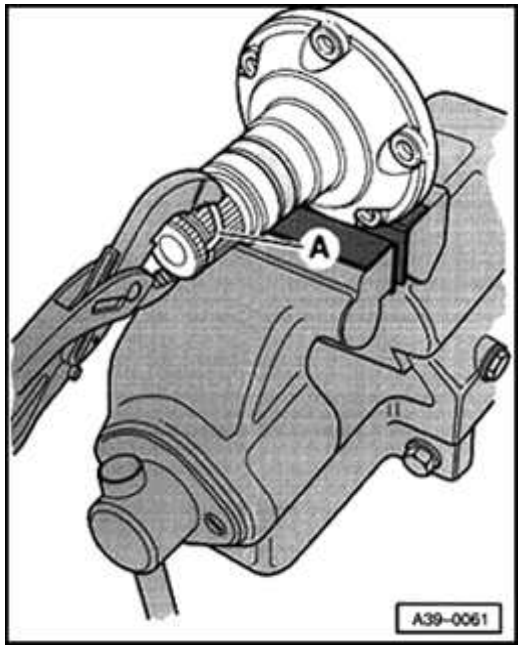


Fig. 1 Removing and installing circlip

- Clamp drive flange in vise using protective jaws and remove circlip by pressing new circlip -A- into groove.

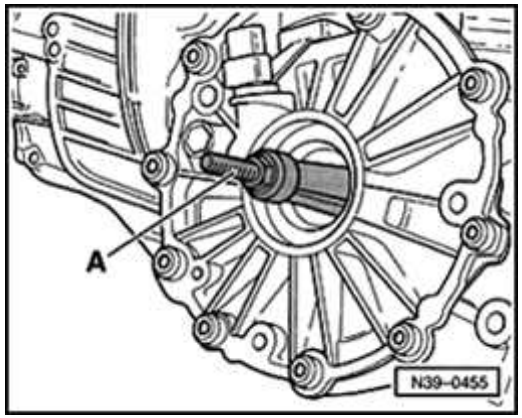


Fig. 2 Removing spacer ring

A - Internal puller 18.5-23.5 mm, e.g. 21/3 Kukko extractor

- If spacer ring is tight, pull out using multi-purpose tool VW771 slide hammer-complete set.

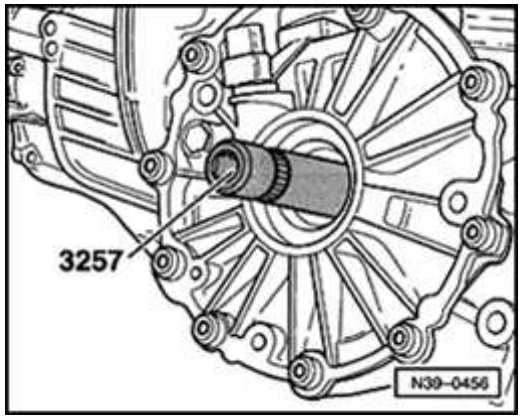


Fig. 3 Installing spacer ring

- Drive in spacer ring up to stop, without canting.

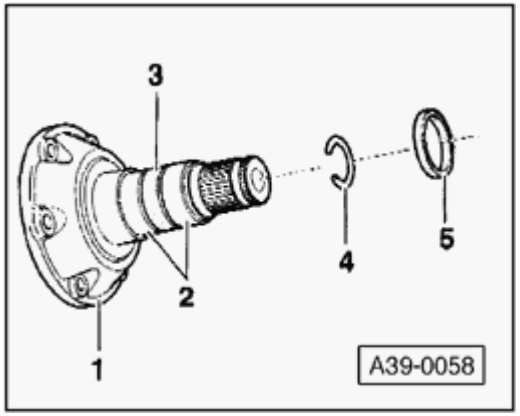


Fig. 4 Drive flange assembly

1 - Drive flange

2 - Needle bearing (polygon bearing)

3 - Spacer ring

4 - Spacer ring

Installed on shafts with 30 mm (1.181 in.) spline diameter

5 - Circlip

Note:

The needle bearings (polygon bearings) do not turn easily when the drive flanges are removed. This does not indicate that the bearings are defective.

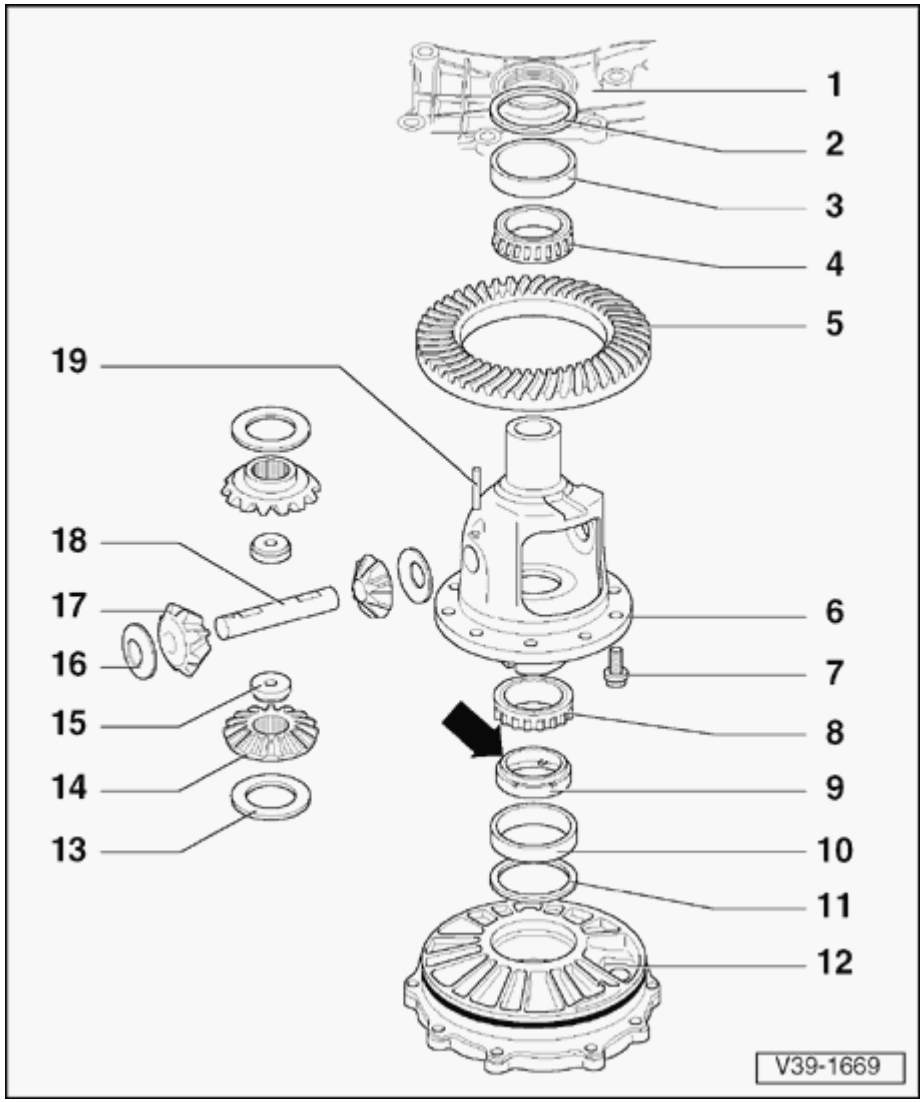
Differential, disassembling and assembling

Special tools, testers and auxiliary items required:

- Drift VW 295
- Thrust plate VW 401
- Thrust plate VW 402
- Press tool VW 412
- Installing tool VW 459/2
- Thrust plate 30-205
- Mandrel 30-505
- Press tool 40-21
- Thrust plate 40-105
- Thrust pad 3062

- Drift 3138
- Tapered roller bearing puller V.A.G 1582
- Grip V.A.G 1582/3
- Grip V.A.G 1582/6

39-18



Notes:

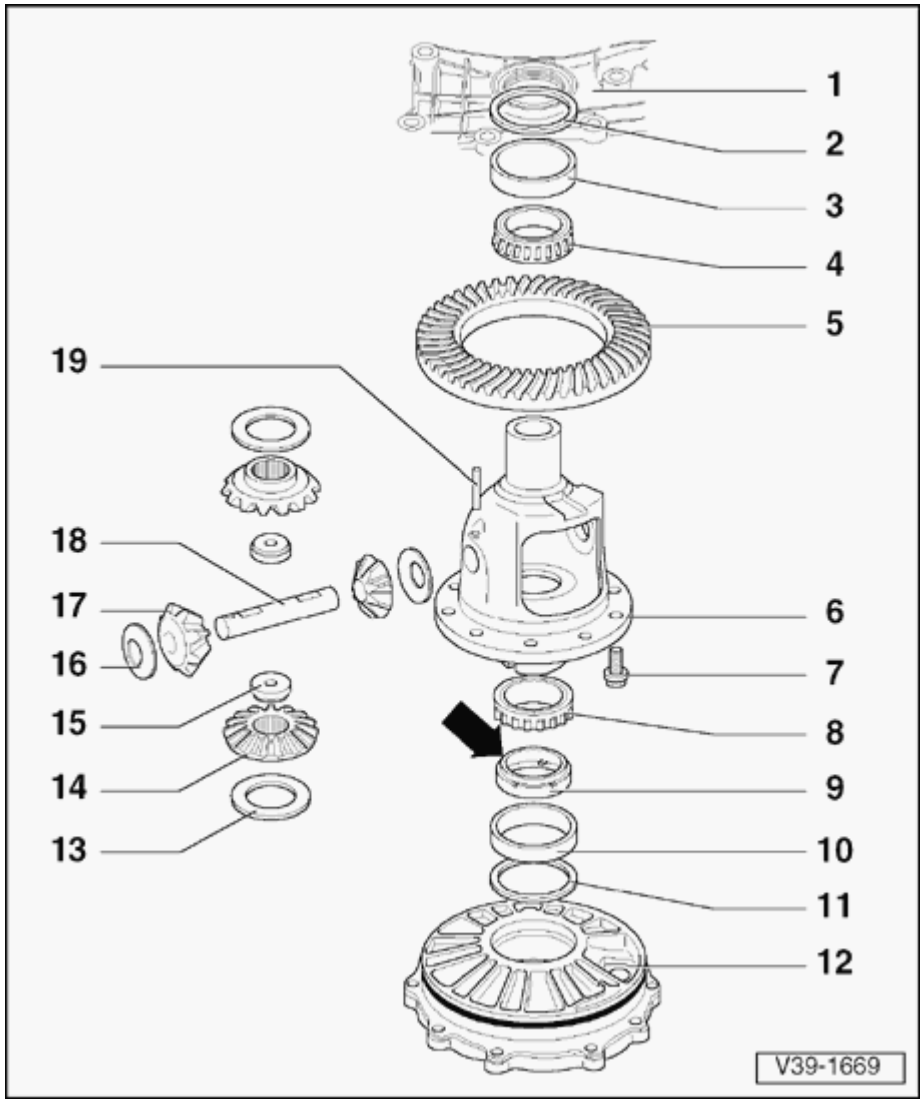
- *Removing and installing differential* ⇒ *Page 39-15* .
- *Adjustments are required when replacing components marked 1)* ⇒ *Page 39-37* , *adjustment overview*

1 - Transmission housing 1)

2 - Shim "S2"

- Note thickness
- Adjustment overview ⇒ Page 39-37

39-19



3 - Outer race for small tapered roller bearing 1)

- Driving out ⇒ Fig. 9
- Driving in ⇒ Fig. 10

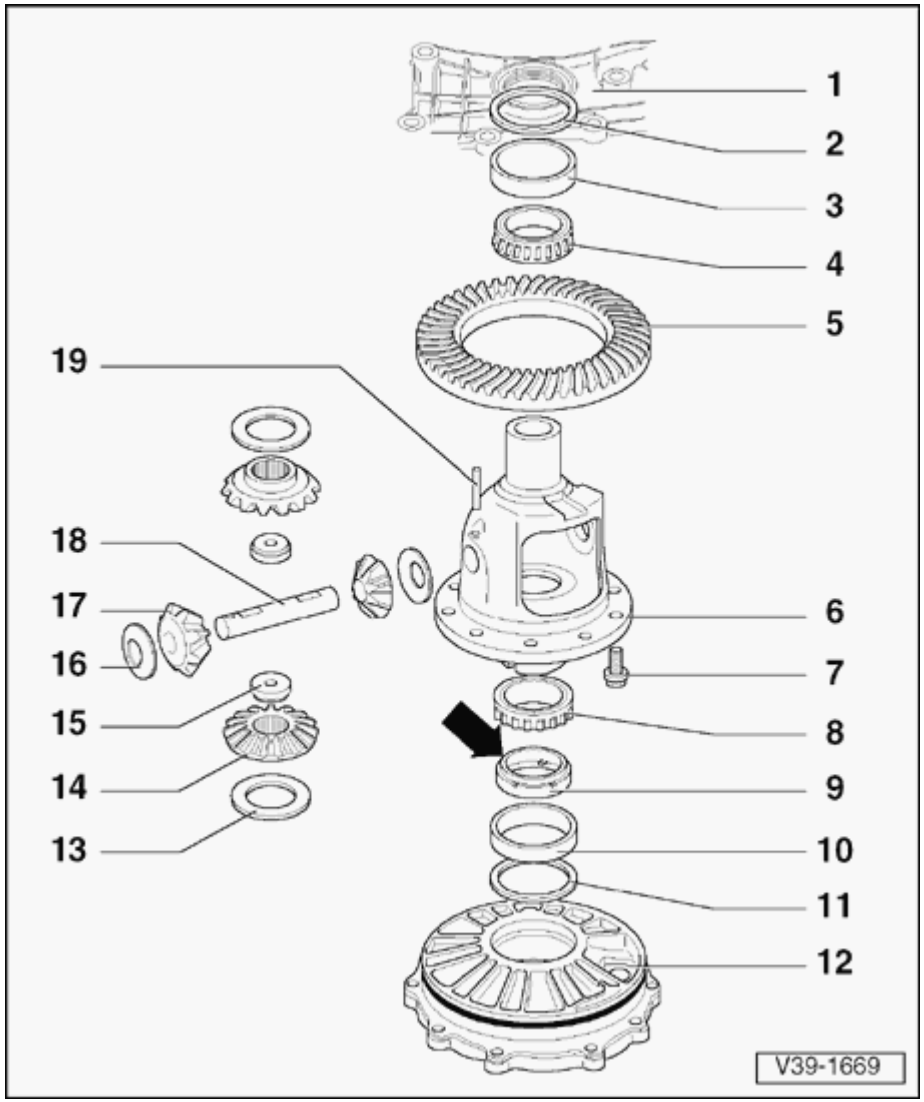
4 - Inner race for small tapered roller bearing 1)

- Pulling out ⇒ Fig. 1
- Pressing in ⇒ Fig. 3
- Low friction bearing; do not oil when measuring frictional torque

5 - Ring gear 1)

- Paired with drive pinion (final drive set)
- Removing ⇒ Fig. 5
- Installing ⇒ Fig. 6

6 - Differential housing 1)



7 - Ring gear bolt, 60 Nm + 45° further

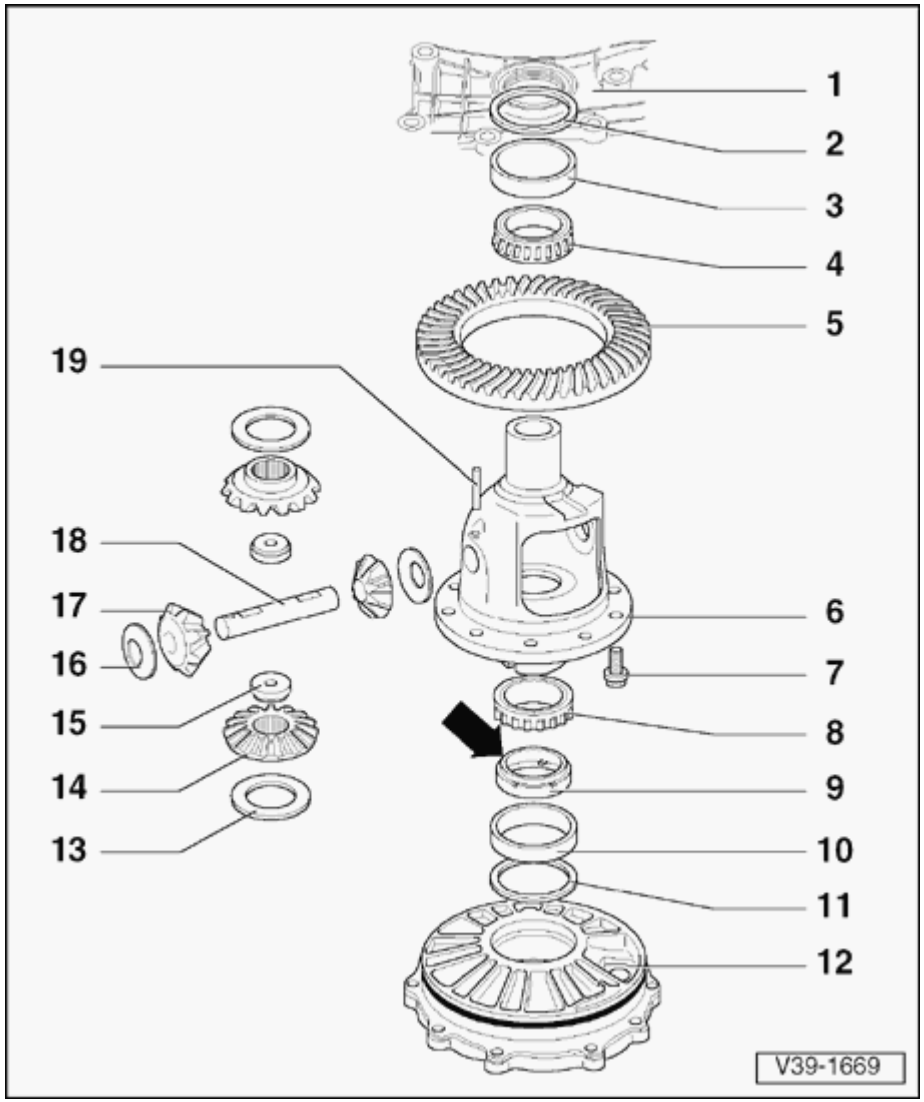
- Always replace
- Use only genuine bolts

8 - Inner race for large tapered roller bearing 1)

- Pulling off ⇒ Fig. 2
- Pressing on ⇒ Fig. 4
- Low friction bearing; do not oil when measuring frictional torque

9 - Drive wheel

- For speedometer sender
- Removing and installing ⇒ Page 39-4
- Fit the drive wheel carefully onto the differential, making sure that it is kept straight. Do not use force; the drive wheel can break easily
- Installation position: shoulder (arrow) toward differential



10 - Outer race for large tapered roller bearing 1)

- Driving out ⇒ Fig. 11
- Driving in ⇒ Fig. 12

11 - Shim "S1"

- Note thickness
- Adjustment overview ⇒ Page 39-37

12 - Cover for final drive 1)

- With O-ring
- Replace O-ring
- Oil O-ring before installing

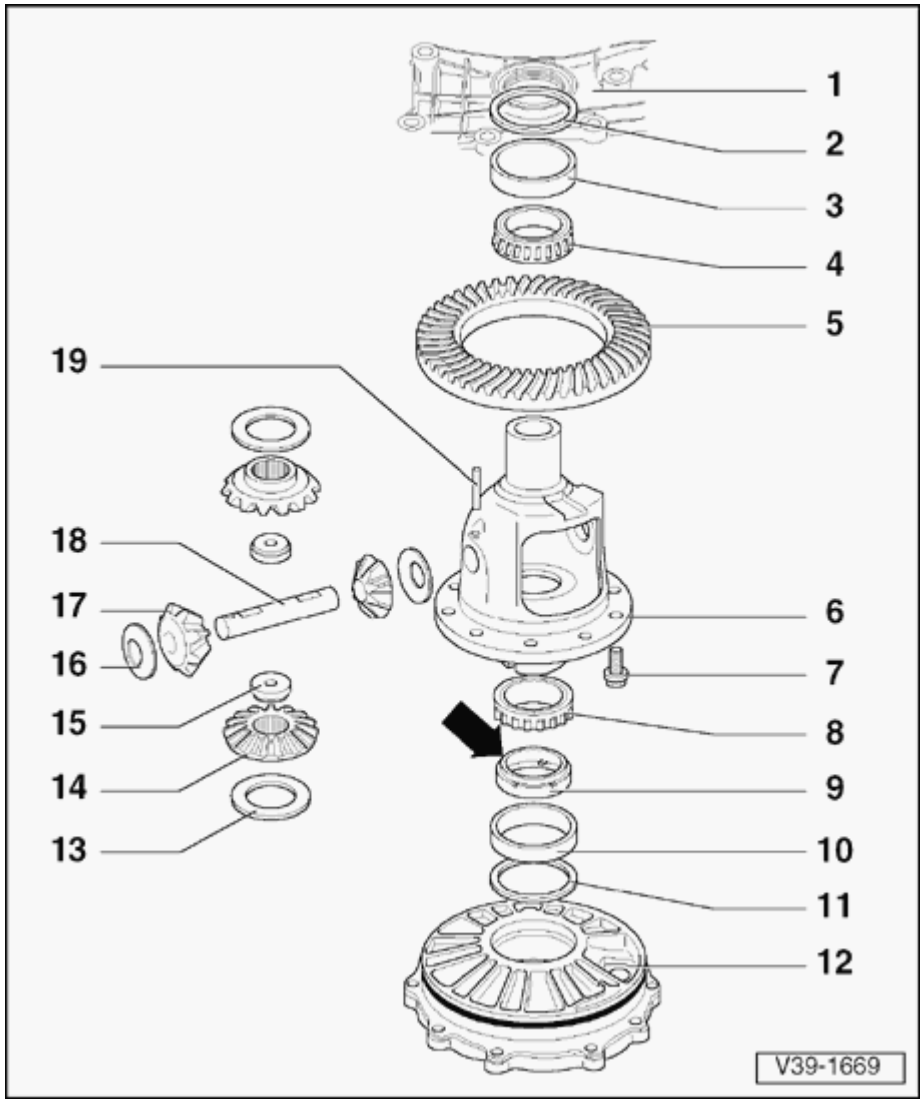
13 - Shims

- Re-determining thickness ⇒ Fig. 8

14 - Sun wheels

- Adjusting ⇒ Fig. 8

39-22



15 - Threaded piece

16 - Thrust washer

- Check for cracks and chipping

17 - Planet wheels

- Installing ⇒ Fig. 7

18 - Shaft for planet wheels

- Drive out with drift after removing spring pin
- Before driving in, align thrust washers

19 - Spring pin

- Drive in flush

39-23

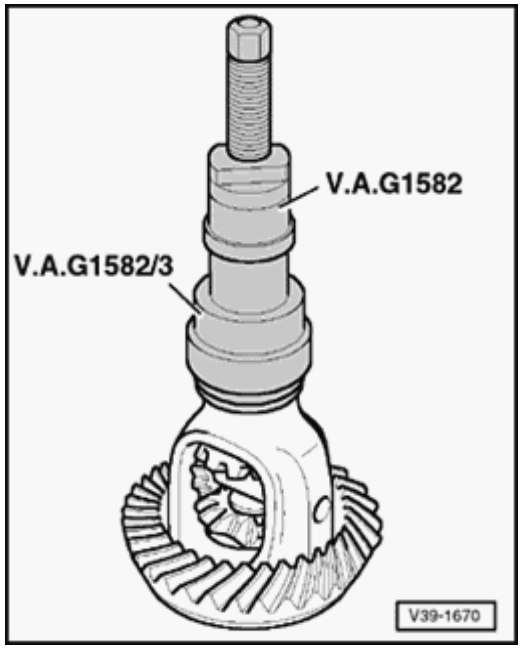


Fig. 1 Pulling inner race for small tapered roller bearing out of housing

- Fit thrust plate 40-105 before fitting puller.

39-24

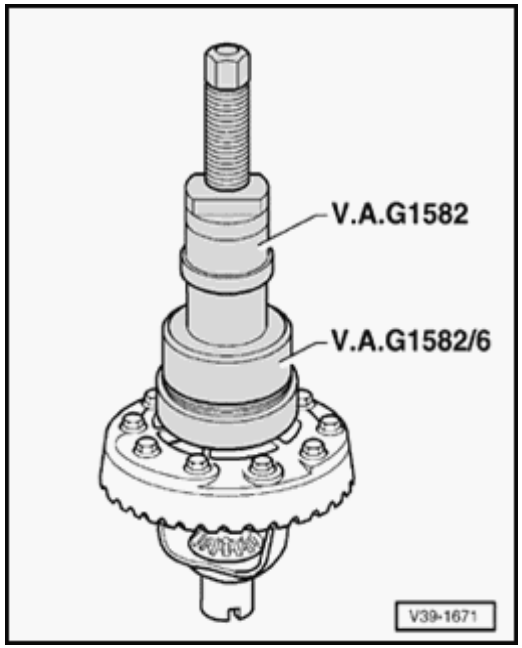


Fig. 2 Pulling inner race for large tapered roller bearing off housing

- Fit thrust plate 40-105 before fitting puller.

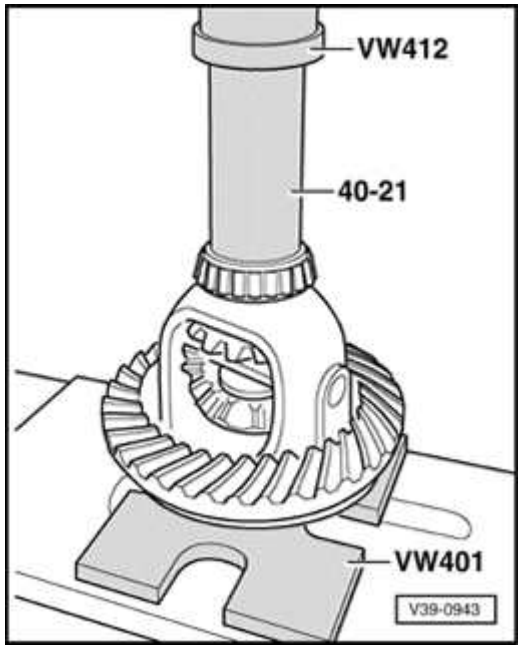


Fig. 3 Pressing on inner race for small tapered roller bearing

- Heat bearing to approx. 10 ° C, fit in position and press home.

39-26

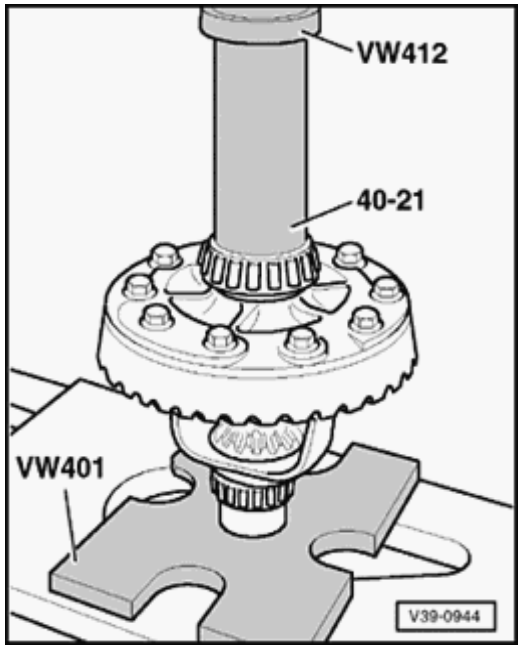


Fig. 4 Pressing on inner race for large tapered roller bearing

- Heat bearing to approx. 100 ° C, fit in position and press home.

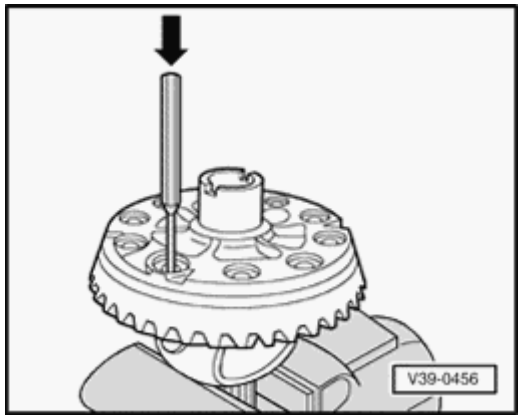


Fig. 5 Driving ring gear off housing

39-27

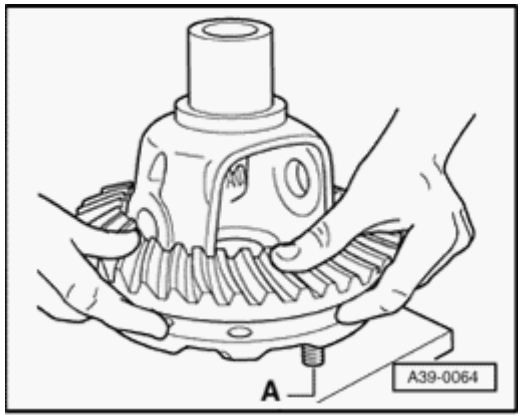


Fig. 6 Installing ring gear

- Use 2 centering pins -A- (local manufacture) as a guide.

CAUTION!

Wear protective gloves.

- Heat ring gear to approx. 100 ° C and install.
- Allow ring gear to cool off slightly before inserting bolts. Then tighten to specified torque.

39-28

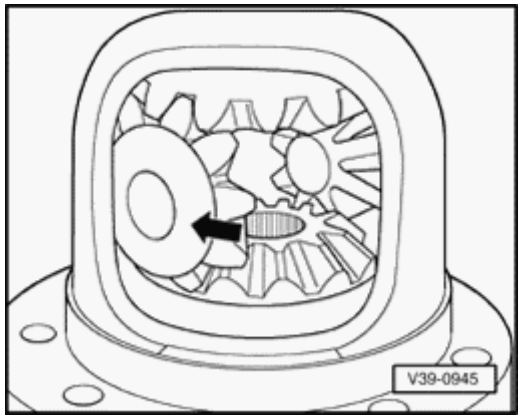


Fig. 7 Installing planet wheels and sun wheels

- Carefully pry out drive wheel for speedometer sender with a screwdriver.
- Insert thrust washers for planet wheels with a small amount of grease.
- Insert sun wheels with selected shims ⇒ Fig. 8 .
- Insert planet wheels spaced 180° apart and rotate into position (arrow).
- Insert threaded pieces.

  Installation position: stepped shoulder toward sun wheels
- Locate thrust washers and planet wheels so that they align with holes.
- Drive planet pinion shaft into final position and secure.

39-29

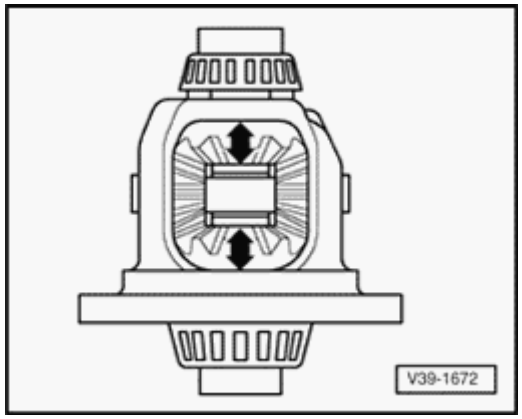


Fig. 8 Adjusting planet wheels and sun wheels

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet wheels with thrust washers and press in shaft.

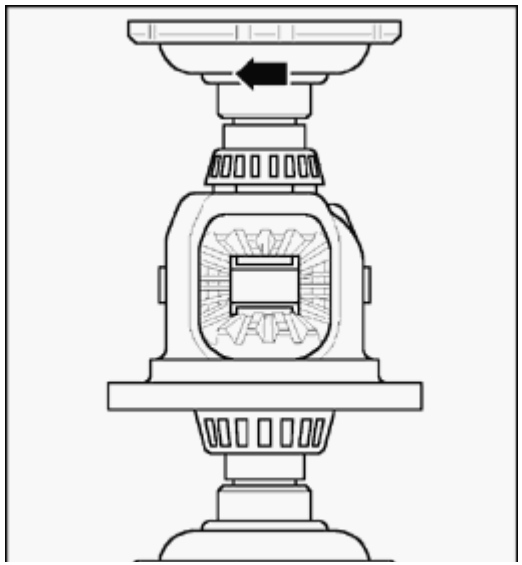
Note:

Do not now interchange bevel gears and thrust washers!

- Press planet wheels outward and check play of sun wheels by hand (arrows).
- Adjust play by inserting an appropriate shim ⇒ Page 39-30 .

  Specification: max. 0.10 mm

Note:



The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears (arrow).

- Determine shim from table.

⇒ *Parts catalog*

The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

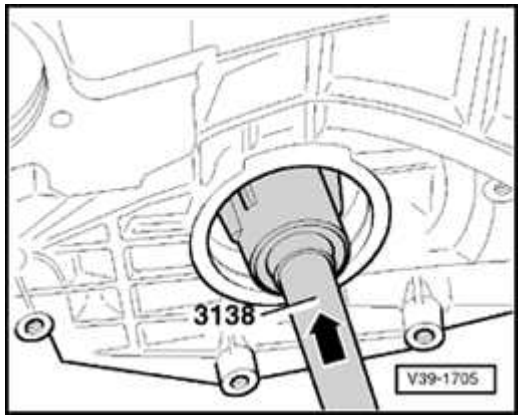


Fig. 9 Driving outer race for small tapered roller bearing out of transmission housing

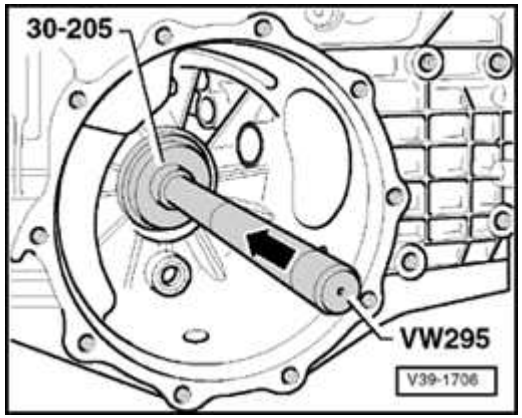


Fig. 10 Driving outer race for small tapered roller bearing into transmission housing

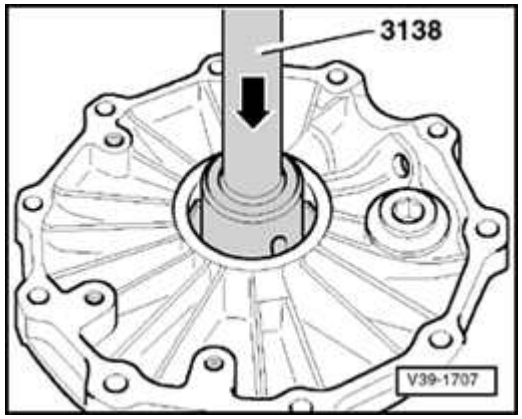


Fig. 11 Driving outer race for large tapered roller bearing out of cover

Use suitable base, e.g. VW 470 with recess toward cover.

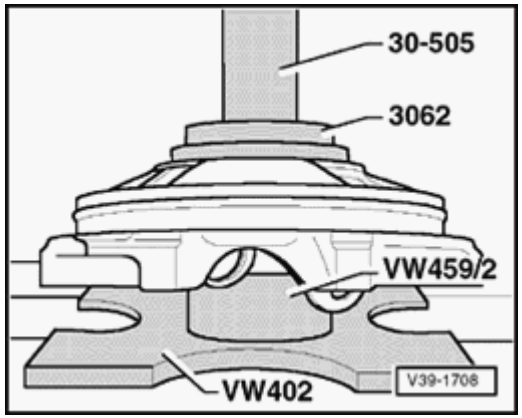


Fig. 12 Driving outer race for large tapered roller bearing into cover

Front final drive differential, disassembling and assembling

Special tools and equipment

- VW295 needle bearing drift
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW447H thrust pad
- VW447I thrust pad
- VW472/1 pressure piece
- VW511 thrust pad
- 30-11 thrust pad

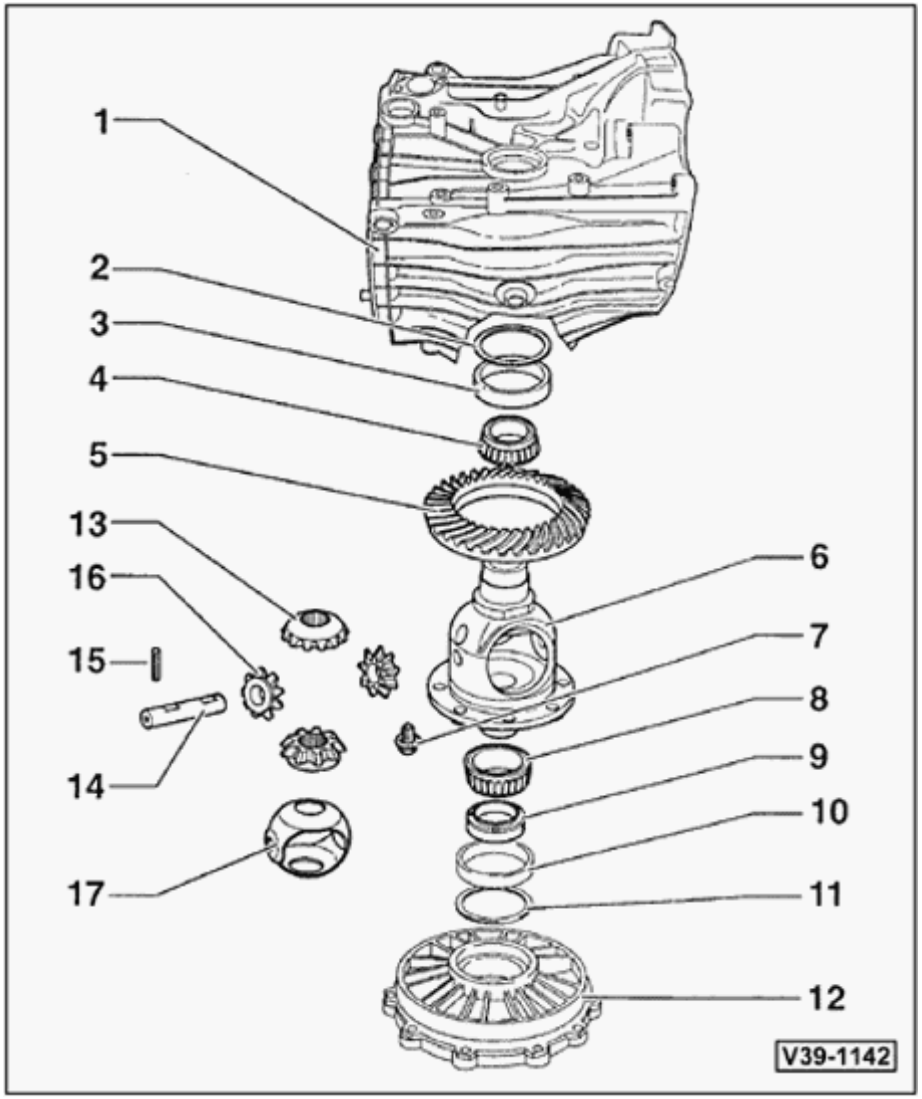
- 30-205 thrust pad
- 40-21 sleeve

- 40-105 thrust piece
- 3138 drift
- 3144 press support
- 3296 tube
- Sealant AMV 188 000 02
- Kukko 20/10 two-arm puller or Kukko 44/2 puller
- Kukko 204/2 two-arm puller

Notes:

- *Differential, removing and installing* ⇒ *Page 39-16* .
- *Replace both tapered roller bearings together.*
- *When replacing parts identified with(*), adjustment work is required* ⇒ *List of adjustments,* ⇒ *Page 39-37* .

39-23



1 - Transmission housing*

2 - Adjustment shim S2

- Note thickness
- List of adjustments ⇒ Page 39-37

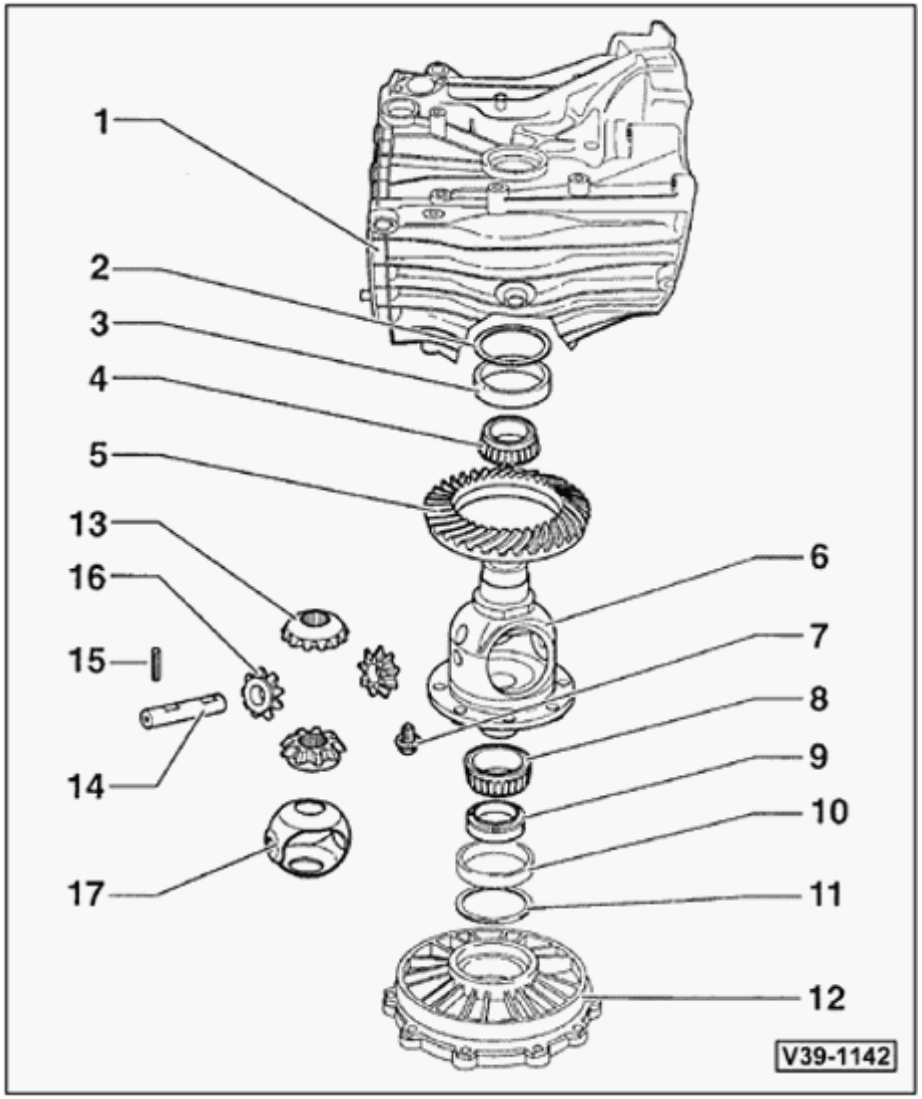
3 - Right tapered roller bearing outer race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 1
- Pressing in using VW472/1 special tool and VW408A punch ⇒ Fig. 2
- Install using VW295 needle bearing drift and 30-205 thrust pad (transmission code CXF)

4 - Right tapered roller bearing inner race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing using 3296 tube ⇒ Fig. 3
- Installing ⇒ Fig. 4
- Transmission code CXF: installl using 40-21 sleeve

39-24



5 - Ring gear*

- Is matched to pinion shaft (gear set)
- Allocate by transmission code ⇒parts catalog, ⇒ Page 00-3
- Remove from differential housing using a drift ⇒ Fig. 9
- Installing on differential housing ⇒ Fig. 10

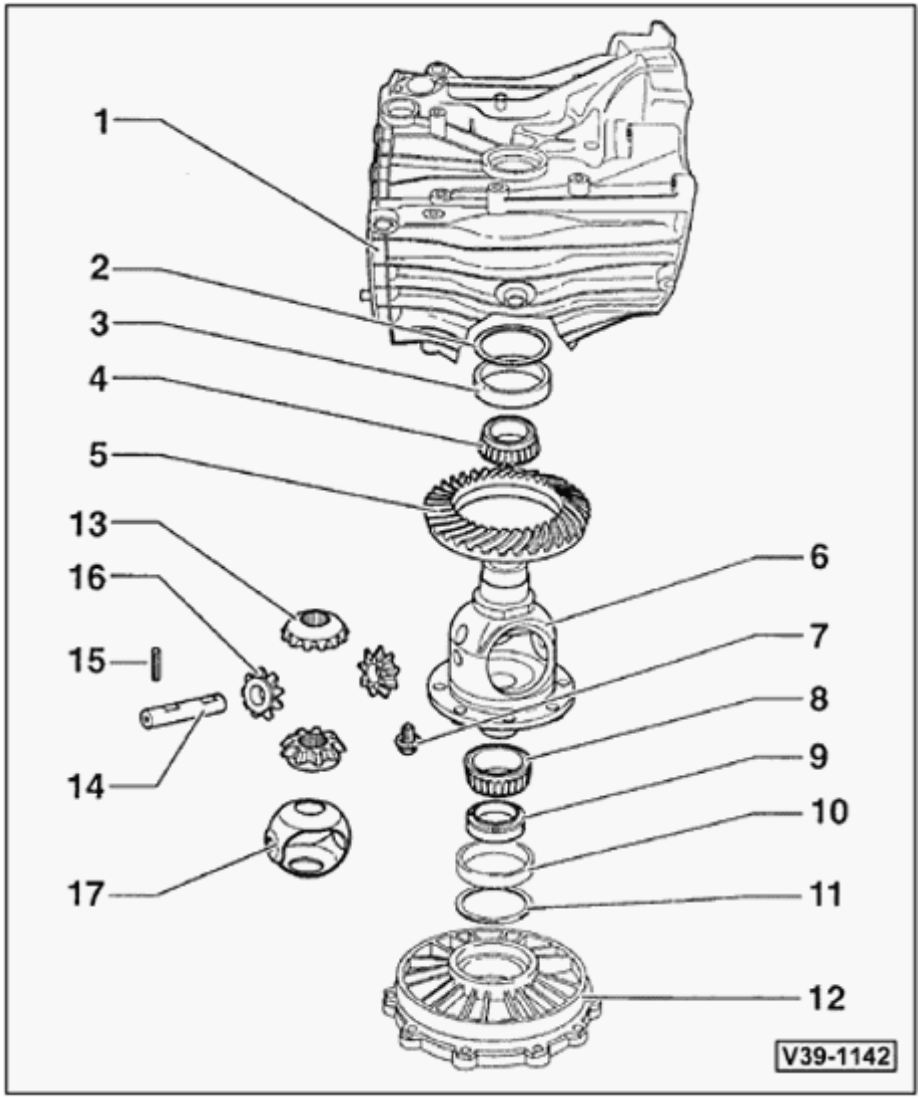
6 - Differential housing*

- Allocate by transmission code ⇒parts catalog
- Transmission identification ⇒ Page 00-3

7 - Ring gear bolt

- Always replace
- Lightly tighten bolts, then tighten diagonally to correct torque
- 60 Nm (44 ft lb) + 1/4-turn (90 °)

39-25



8 - Left tapered roller bearing inner race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 5
- Installing using 3296 tube ⇒ Fig. 6
- Transmission code CXF: install using 40-21 sleeve

9 - Speedometer drive gear

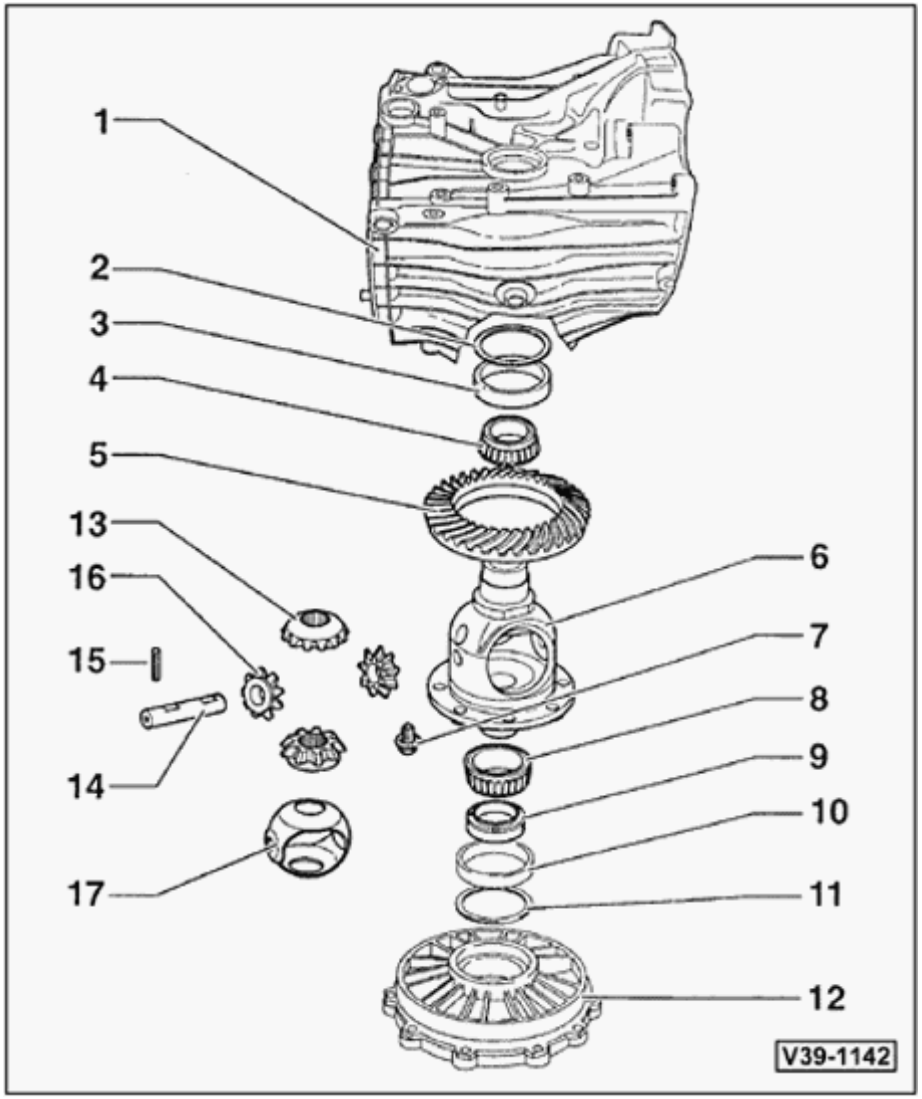
- Removing and installing ⇒ Page 39-14

CAUTION!

Install drive gear carefully onto differential, without canting. Do not use force, the drive gear can break easily.

10 - Left tapered roller bearing outer race*

- Tapered roller bearings on left and right are identical (not for transmission code CXF)
- Removing ⇒ Fig. 7
- Pressing in using VW472/1 special tool and VW408A punch ⇒ Fig. 8
- Press in using 40-21 sleeve (transmission code CXF)



11 - Adjustment shim S1

- Note thickness
- List of adjustments ⇒ Page 39-37

12 - Differential cover*

13 - Large differential bevel gear

- Installing ⇒ Fig. 11

14 - Differential bevel gear shaft

- Drive out using drift, after removing roll pin

15 - Roll pin

- For securing differential bevel gear shaft
- Version with annular groove, removing and installing ⇒ Fig. 12
- Version without annular groove, drive out using drift

16 - Small differential bevel gears

- Installing ⇒ Fig. 11

17 - Thrust washer assembly

- Coat with transmission oil when installing

39-27

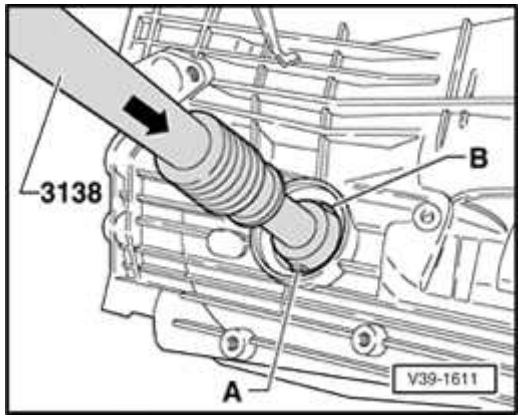


Fig. 1 Removing small tapered roller bearing outer race from transmission housing

- Turn webs -A- and -B- out until they sit on outer race within recess in transmission.
- After removing, check shims for damage.

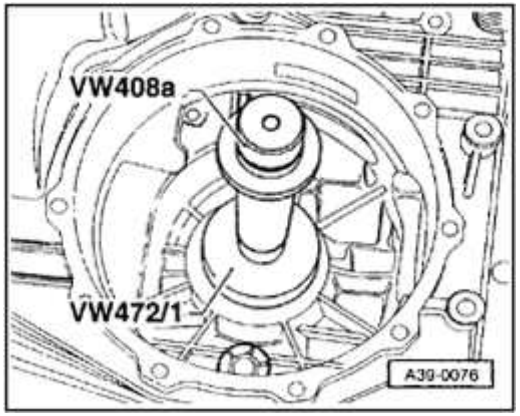


Fig. 2 Installing right tapered roller bearing outer race into transmission housing

- VW472/1 pressure piece is installed with cone in outer race.

Note:

Transmission code CXF: use 30-205 thrust pad and VW295 needle bearing drift.

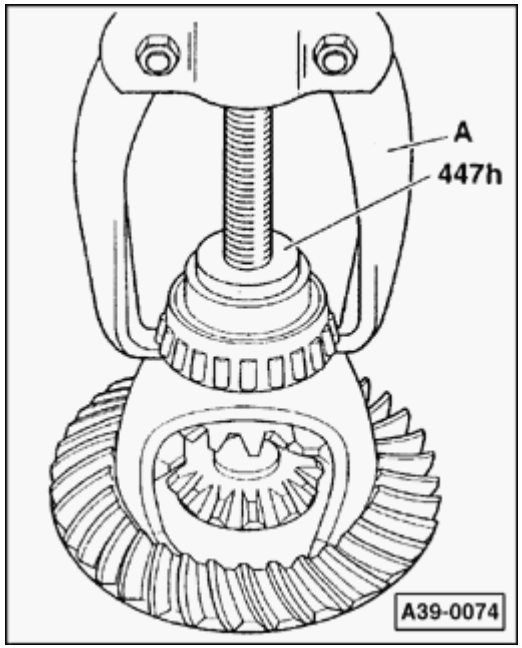


Fig. 3 Removing right tapered roller bearing inner race

A - Kukko 20/10 two-arm puller, e.g. Kukko 44/2

Notes:

- *Pullers with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and the puller.*
- *Transmission code CX: use 40-105 thrust piece.*
- *The differential housing has a notch under the bearing seat to install puller -A-.*

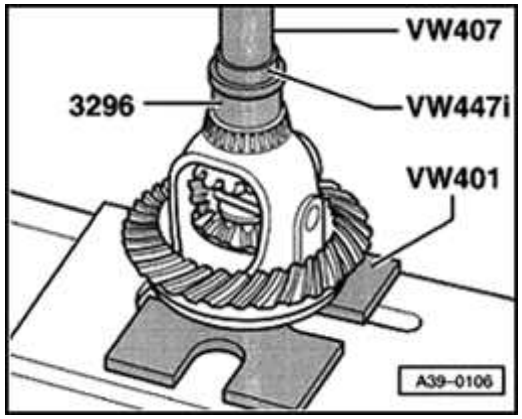


Fig. 4 Installing right tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat inner race to approx. 100 ° C (212 ° F), position and install.

Note:

Transmission code CXF: use 40-21 sleeve.

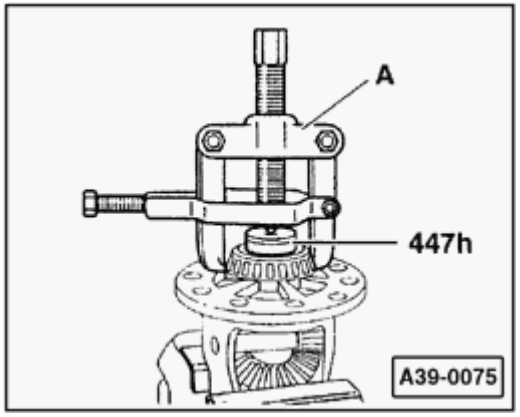


Fig. 5 Removing left tapered roller bearing inner race

A - Two-arm puller, e.g. Kukko 204/2

Notes:

- *On a puller with a small spindle diameter, 30-11 thrust pad must be placed between 447H pressure washer and THE puller.*
- *Transmission code CXF: use 40-105 thrust piece.*
- *The differential housing has a notch under the bearing seat to install puller -A-.*

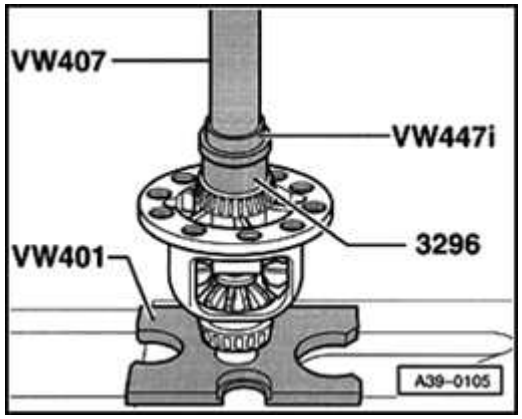


Fig. 6 Installing left tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat inner race to approx. 100 ° C (212 ° F), position and install.

Note:

transmission code CX: , use 40-21 sleeve.

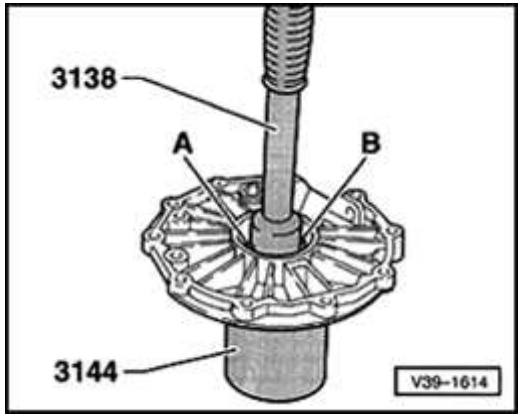


Fig. 7 Removing left tapered roller bearing outer race from differential cover

- Turn webs -A- and -B- out until they sit on outer race within recess in differential cover.
- After removing, check shims for damage.

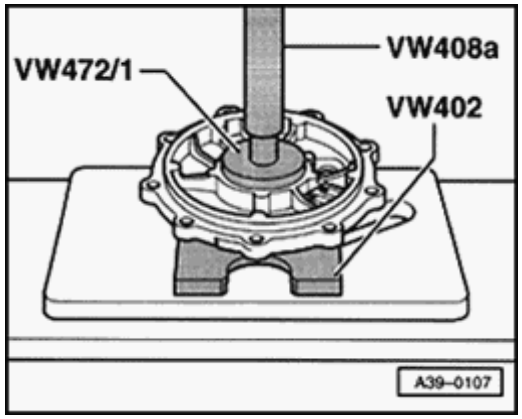


Fig. 8 Installing left tapered roller bearing outer race into differential cover

- VW 472/1 pressure piece is installed with cone in outer race.

Note:

Transmission code CXF: use VW511 thrust pad and VW295 needle bearing drift.

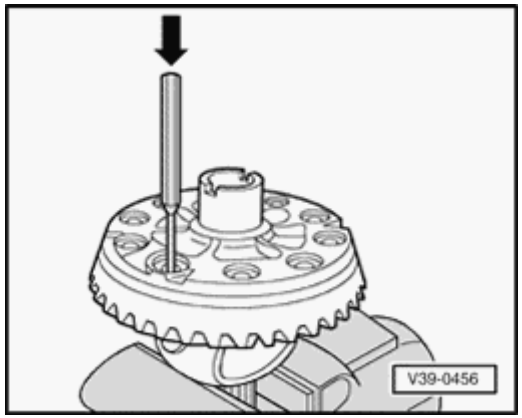


Fig. 9 Removing ring gear from differential housing

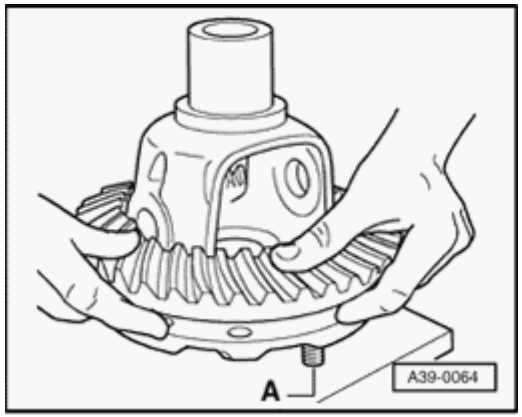


Fig. 10 Installing ring gear

WARNING!

Wear protective gloves.

- When installing ring gear, guide with centering pins -A- (local manufacture).
- Heat ring gear to approx. 100 ° C (212 ° F) and install.
- Allow ring gear to cool off slightly before inserting bolts.
- Tighten to specified torque.

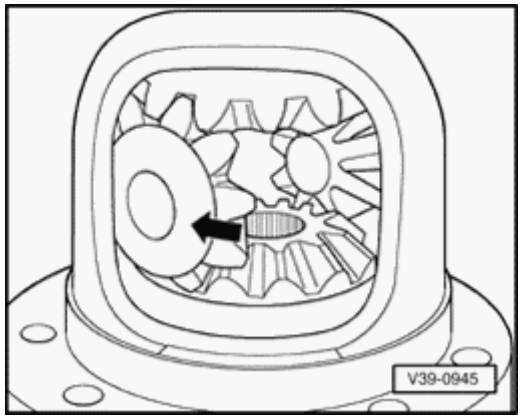


Fig. 11 Installing differential bevel gears

- Lubricate one-piece thrust washer with transmission oil and install.
- Install large differential bevel gears.
- Insert small differential bevel gears at 180 ° from their final position, and rotate into place (arrow).
- Drive small differential bevel gear shaft into final position and secure.

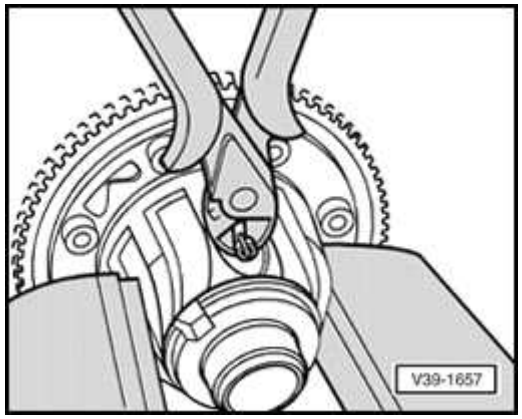


Fig. 12 Removing and installing roll pin

Removing

Roll pin with annular groove:

- Remove using diagonal-cutting pliers.

Roll pin without annular groove:

- Remove from behind, using punch.

Installing

- Install roll pin until stop is reached.

Pinion shaft and ring gear, adjusting

Notes:

- *Careful adjustment of the pinion shaft and ring gear is essential for the service life and smooth running of the final drive. For this reason, the pinion shaft and the ring gear are matched together during manufacturing and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the pinion shaft in an axial direction, and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*

- *The goal of the adjustment is to reproduce the setting for the quietest possible running, as obtained on the test machine during production.*

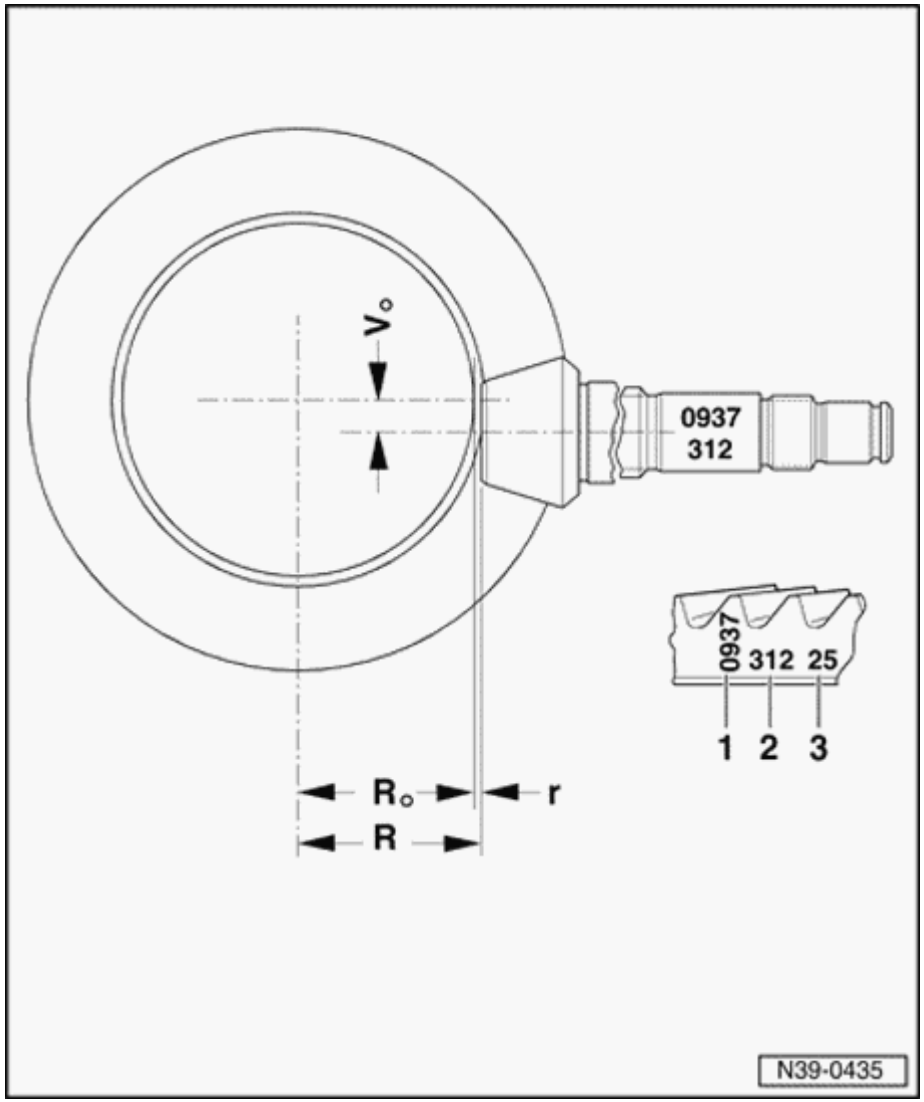
- *The deviation, or tolerance "r" which is based on the master gauge "R0" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (pinion shaft and ring gear) must only be replaced together as a matched pair.*

- *Observe the general repair instructions for*

tapered roller bearings and adjustment shims.

- *The friction torque measurement only serves as a final check of the adjustment.*

39-30



Adjustment and marking of final drive gear sets

1 - Identification "0397" signifies an Oerlikon gear set with a ratio of 37:9

2 - Pairing number (312) of final drive gear set

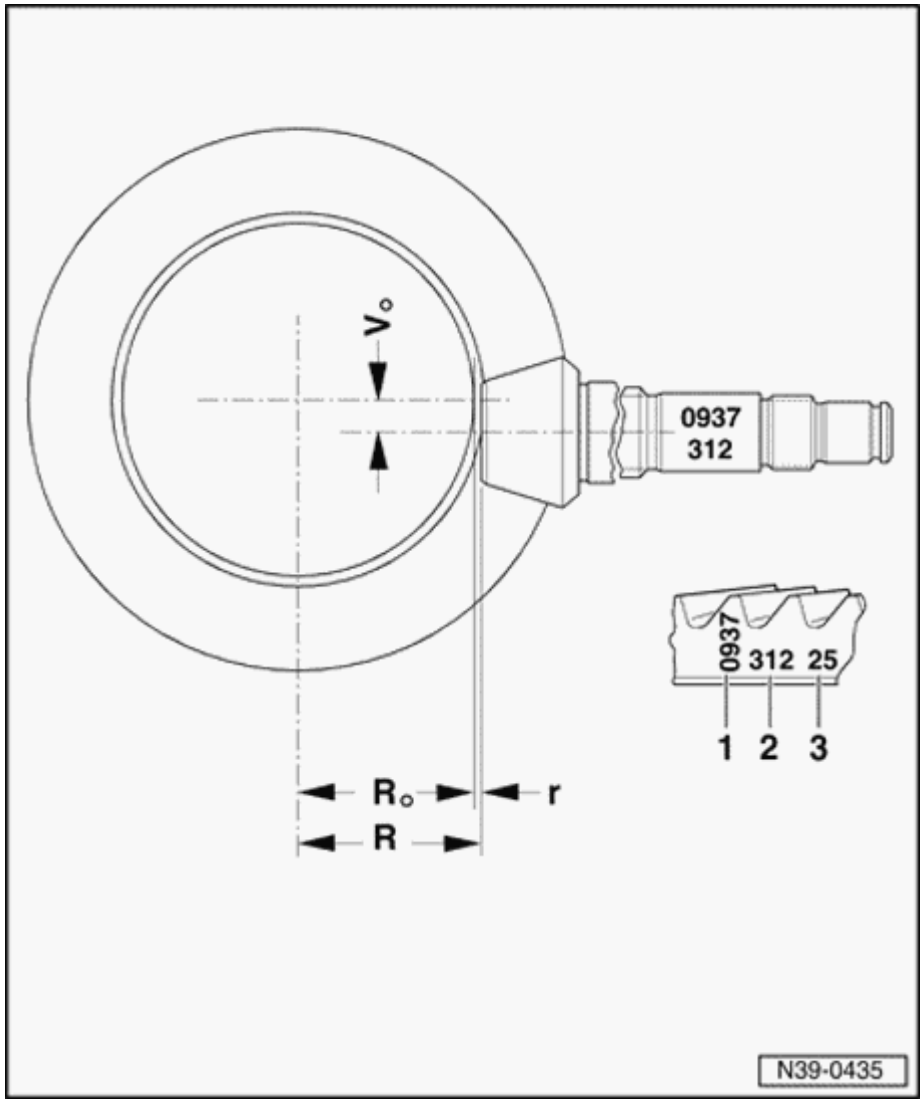
3 - Deviation (tolerance) "r" is based on the test machine master gauge used during production. The deviation "r" is always given in 1/100 mm. Example: 25 signifies "r" = 0.25 mm

Ro - Length of test machine master gauge

Ro - Ring gear diameter 170 mm = 54.95 mm

Ro - Ring gear diameter 180 mm = 59.65 mm

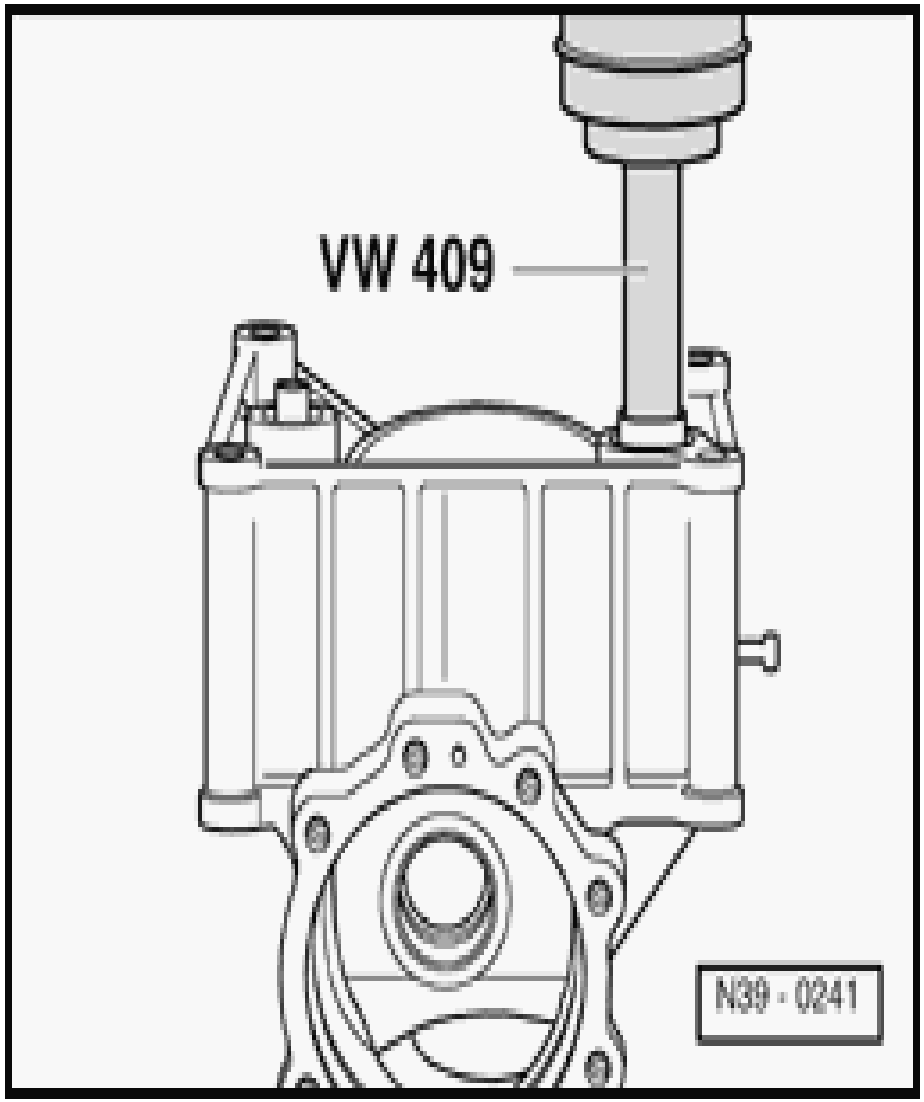
39-31



R - Actual dimension between ring gear axis and face of pinion shaft in position of quietest running for this gear set

Vo - Hypoid offset

39-32



Installation position of adjustment shims

Note:

List of adjustments when replacing individual components of transmission ⇒ *Page 39-33* .

S1 - Adjustment shim for ring gear in final drive cover

S2 - Adjustment shim for ring gear in transmission housing

S3 - Adjustment shim for pinion shaft in transmission housing

S4 - Adjustment shim for pinion shaft in transmission cover

39-33

List of adjustments

Note:

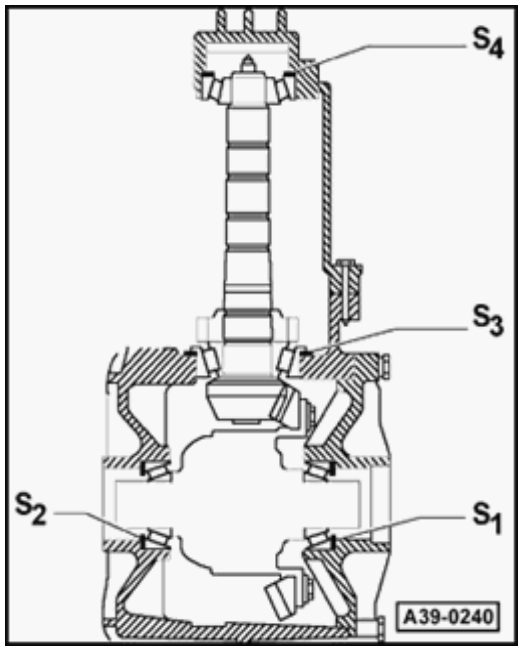
If repairs have been carried out on the transmission, it is only necessary to adjust the pinion shaft, ring gear or gear set if components have been replaced that directly influence the final drive adjustment. To avoid unnecessary adjustments, refer to the following table:

Component replaced: ▼	**Component to be adjusted:**			
	Ring gear "S1"+ "S2" 1) ⇒ Page 39-52	Pinion shaft "S3"+ "S4" 1) via deviation "r" ⇒ Page 39-35	Pinion shaft "S4" 1) ⇒ Page 39-49	Backlash measurement ⇒ Page ⇒ Page 39-58
Transmission housing 3)	X	X		X
Transmission cover			X	
Differential housing	X			X
Tapered roller bearing for pinion shaft		X		X
Tapered roller bearing for differential	X			X
Gear set 2)	**X**	X		X
Cover for final drive	X			X

1) Adjustment shims: installation position ⇒ Page 39-32 .

2) Replace pinion shaft and ring gear together as a set only.

3) If the transmission housing is replaced, adjust input shaft ⇒ Page 35-17 .



Sequence for adjusting gear set

If pinion shaft and gear ring have to be adjusted, the following sequence is recommended for maximum efficiency:

1.) Determine total shim thickness Stotal for S1 + S2 (adjusting preload for tapered roller bearing for differential) ⇒ Page 39-53 .

2.) Determine total shim thickness Stotal for S3 + S4 (adjusting preload for tapered roller bearing for pinion shaft) ⇒ Page 39-37 .

3.) Distribute total shim thickness Stotal for S3 + S4 so that the dimension between the center of the gear ring and the face of the pinion shaft equals dimension "R" which was determined during production ⇒ Page 39-45 .

4.) Distribute total shim thickness Stotal S1 + S2, so that the specified backlash between ring gear and pinion shaft is maintained ⇒ Page 39-61 .

Note:

Overview of components and shims ⇒ Page 39-32 .

39-35

Pinion shaft, adjusting

Procedures, after which the pinion shaft must be adjusted ⇒ Page 39-33 , table

Special tools and equipment

- VW204B installation tool for crankshaft seal
- VW296 removal tool
- VW385 universal gauge
- VW385/1 measuring bar
- VW385/2 centering disc (for transmissions without polygon bearing)
- VW383/3 centering disc (2x)
- VW385/14 measuring rod
- VW385/15 extension pin
- VW385/30 master gauge (adjustable)

- VW385/33 end gauge
- VW387 Dial Gauge Holder
- VW401 thrust plate
- VW407 punch

39-36

- VW519 sleeve
- VW792 installation arbor
- 3005 thrust pad
- Torque gauge 0-600 Ncm
- Dial indicator
- Dial indicator extension 9.3 mm
- Dial indicator extension 6.5 mm
- Dial indicator extension 30 mm

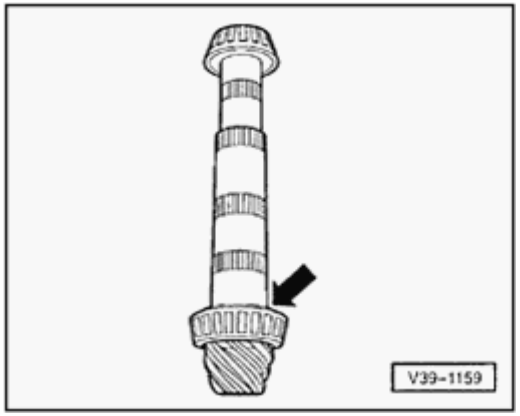
39-37

Determining total shim thickness Stotal for shims S3 + S4

- Adjust preload of tapered roller bearing for pinion shaft.

• Differential removed

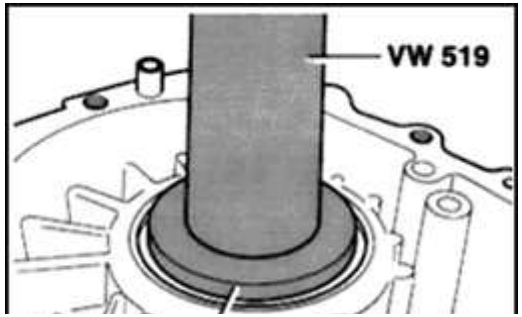
- Pressing on double tapered roller bearing inner race ⇒ Page 35-21 .



- Secure lower tapered roller bearing (arrow).

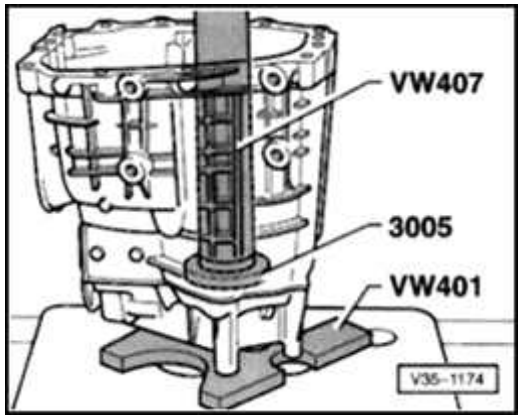
Note:

The illustration shows the pinion shaft without gears.



- Install tapered roller bearing outer race for pinion shaft without shims into transmission housing ⇒ Fig. 3, ⇒ Page 35-30 .
- Install rubber washer (item 40 , Page ⇒ Page 35-28) and pressure plate (item - 39 -, Page ⇒ Page 35-28) into transmission cover.

Pressure plates with a thickness of 14.8 mm or 15.3 mm can be installed.

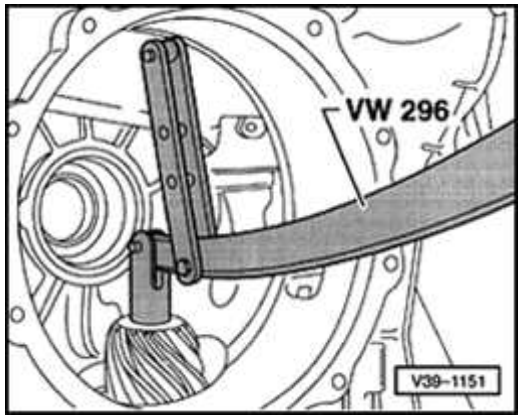


- Install tapered roller bearing outer race for pinion shaft with shim S4* (1.0 mm thickness) into transmission cover ⇒ Fig. 8, ⇒ Page 35-32 .

Note:

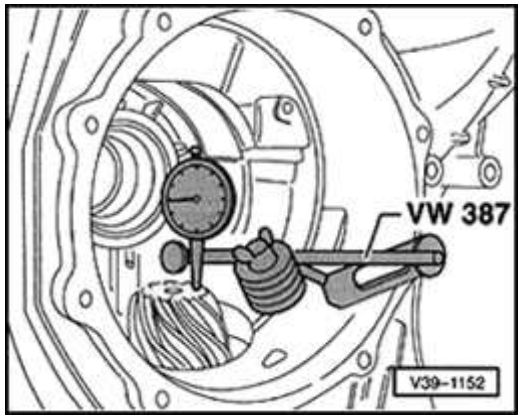
A shim S4 with a thickness of 1.0 mm is installed for initial measurement. It is referred to in the following text as S4. After determining measurement "e," S4* is replaced with the appropriate shim S4.*

- Install fully assembled pinion shaft into transmission housing.
- Install transmission cover and tighten to 22 Nm (16 ft lb).
- Turn transmission so that the transmission cover points downward.



- Press down on face of pinion shaft using VW296 removal tool until tapered roller bearing outer race contacts transmission cover.
- While maintaining pressure, turn pinion shaft by hand to seat tapered roller bearing.

39-39

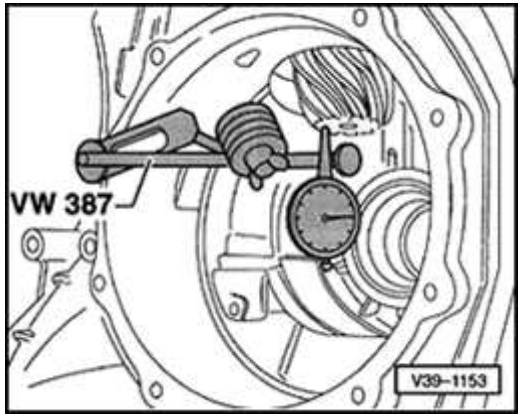


- Assemble measuring equipment, use 30mm dial indicator extension.
- Set dial indicator (3 mm measuring range) to 0 with 1mm preload.

Note:

Make sure dial indicator extension contacts machined surface on face of drive shaft.

- Turn transmission 180 ° , so transmission cover faces upward.
- Turn pinion shaft 5 rotations in each direction to seat the tapered roller bearing.



- Read play on dial indicator and note.

  Dimension in the following example: 0.45 mm

Note:

If the measurement has to be repeated, first turn pinion shaft 5 rotations in both directions to seat the tapered roller bearing. Set dial indicator to 0 with 2mm preload.

39-40

Formula:

"Stotal" = "S4*" + measured value + bearing preload

Example:

	Installed shim "S4*"	1.00 mm
+	Dimension (example)	0.45 mm
+	Bearing preload (constant)	0.15 mm
=	Total shim thickness "Stotal" for "S3 + S4"	1.60 mm

39-41

Determining thickness of shim "S3*"

Formula:

"S3*" = "Stotal" - "S4*"

Example:

	Total shim thickness "Stotal" for "S3 + S4"	1.60 mm
-	Installed shim "S4*"	1.00 mm
=	Thickness of shim "S3*"	0.60 mm

- Remove tapered roller bearing outer race, install shim "S3*" into transmission housing and re-install outer race ⇒ Fig. 3, ⇒ Page 35-30 .

- Install fully assembled pinion shaft into transmission housing.

- Install transmission cover and tighten to 22 Nm (16 ft lb).

39-42

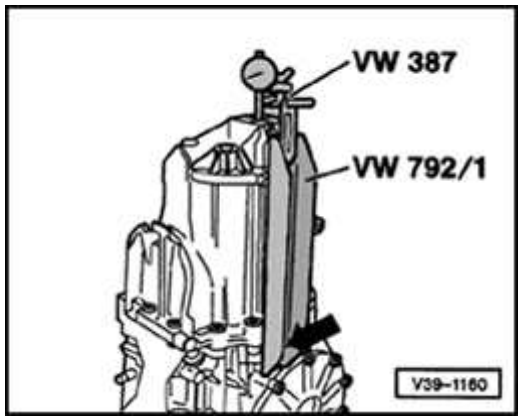
Checking preload for tapered roller bearing for pinion shaft

- Turn pinion shaft 5 rotations in each direction to seat tapered roller bearing.

Notes:

- *If the pinion shaft cannot be turned by hand, install a M10 x 20 bolt into face of pinion shaft and turn the pinion shaft at this bolt using tool.*

- *Remove bolt after turning pinion shaft.*



- Install measuring tools and secure to transmission housing with bolt (arrow).
- Attach dial indicator (3mm measuring range) to center of transmission cover and set to 0 with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft.

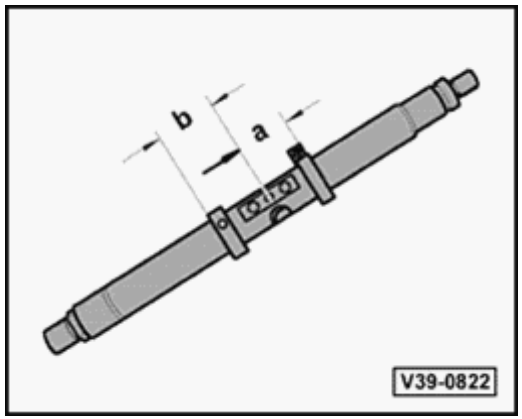
  If correct shims have been selected, dial indicator will now indicate the following value: 0.05-0.15 mm.
- Tighten transmission cover bolts to 22 Nm (16 ft lb).
- Remove measuring tools.
- Turn pinion shaft 5 rotations in each direction to seat tapered roller bearing.

39-43

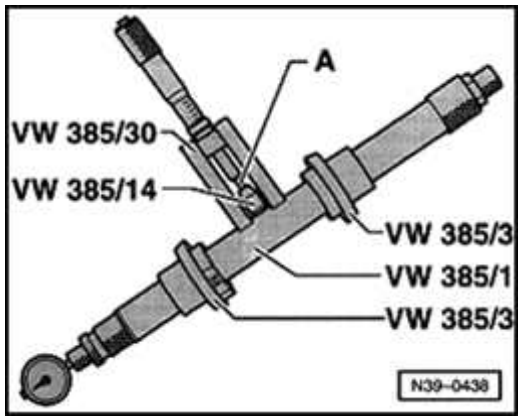
Calculating dimension "e"

Note:

Dimension "e" is required to determine the final shim thickness of S3 and S4.



- Set adjustment rings of universal mandrel using VW385/1 measuring bar to the following measurements:
  - Dimension -a- = 35 mm
  - Dimension -b- = 75 mm



- Assemble VW385/1 measured bar as illustrated:

Dial indicator extension A	Ro	Ring gear diameter
6.5 mm for VW385/30 master gauge	54.95	170 mm
9.3 mm for VW385/15 extension pin	59.65	180 mm

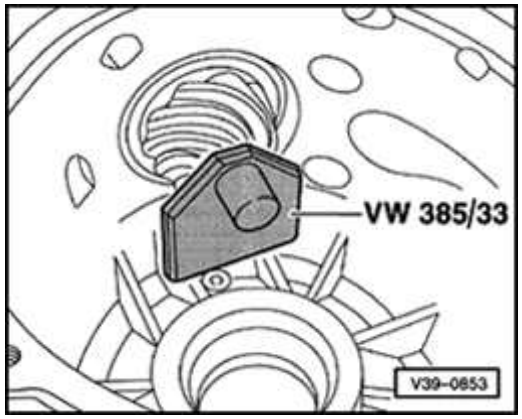
- Set dial indicator (3 mm measuring range) to 0 with 2mm preload.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use VW385/2 centering disc instead of VW385/3 centering disc

opposite dial indicator.

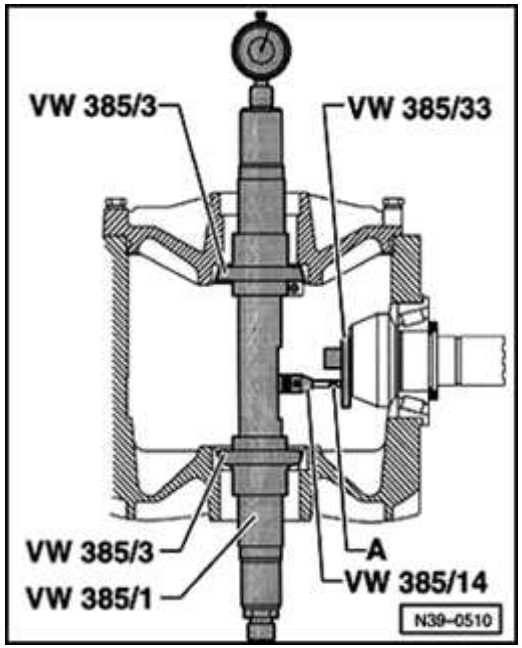
39-44



- Place end gauge on face of pinion shaft.

Note:

Make sure gauge contact surface is precisely installed and free of oil.

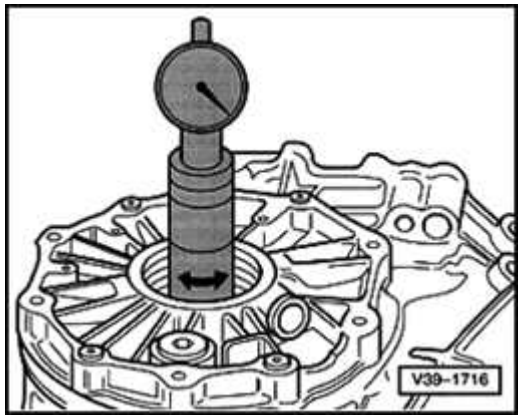


- Remove master gauge and install measuring mandrel into transmission housing.
  - Dial indicator extension -A- = 6.5 mm long must be installed
  - VW385/3 centering disc faces cover for final drive
- Install differential cover and tighten 4 bolts to 22 Nm (16 ft lb).
- Using adjustable ring, pull 2nd VW385/3 centering disc out as far as possible, so mandrel can only just be turned by hand.

Note:

For transmissions with drive flange without polygon bearing (⇒ Page 00-3) use VW385/2 centering disc instead of VW385/3 centering disc opposite dial indicator.

39-45



- Turn mandrel until dial indicator plunger tip touches end gauge on pinion shaft head, measure maximum runout (return point).

Measurement in following example "e" = 0.26 mm (red scale)

Note:

After removing universal mandrel, and with VW385/30 master gauge in place, check dial indicator again to see if it indicates "0" with 2 mm preload, otherwise correct adjustments.

Determining thickness of shim "S3"

Formula:

S3 = S3* + r + e

(-e- in black scale)

or

S3 = S3* + r - e

(-e- in red scale)

Notes:

- *The deviation "r" (tolerance) related to the VW385/30 master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear.*
- *If measurements are based on red scale, subtract value "e."*
- *If measurements are based on black scale, add value "e."*

Example:

	Shim S3* installed	0.60 mm
+	Deviation r	0.38 mm
-	Value measured for "e" (in red scale)	0.26 mm
=	Thickness of shim S3	0.72 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S3"

Shim thickness (mm)1)		
0.40	0.55	0.70
0.45	0.60	0.75
0.50	0.65	

1) Using shim tolerances it is possible to find the exact shim thickness required: insert two shims if necessary.

39-47

Determining thickness of shim "S4"

Formula:

S4 = Stotal - S3

Example:

	Total shim thickness Stotal for S3 + S4	1.60 mm
-	Thickness of shim S3	0.72 mm
=	Thickness of shim S4	0.88 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

Available shims for S4

Shim thickness (mm) 1)		
0.49	0.69	0.85
0.57	0.73	0.89
0.61	0.77	
0.65	0.81	

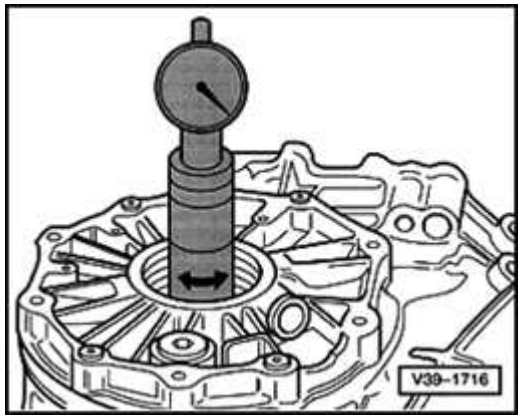
[1)] Using shim tolerances it is possible to find the exact shim thickness required: insert two shims if necessary.

39-48

Checking measurement

Checking dimension "r"

- Install pinion shaft together with measured shims S3 and S4 and turn 5 rotations in both directions.



- Install universal mandrel ⇒ Page 39-43 , Determining dimension "e"; and perform check measurement.
- Read dial indicator counterclockwise (red scale).
  - ♦ If shims have been determined correctly, deviation "r" (as marked on outer circumference of ring gear) should be indicated on dial within a tolerance of ± 0.04 mm.

Note:

After removing universal mandrel, and with VW385/30 master gauge or VW385/15 extension pin in place, check dial indicator again to see if it indicates 0 with 2 mm preload. If not, correct adjustments.

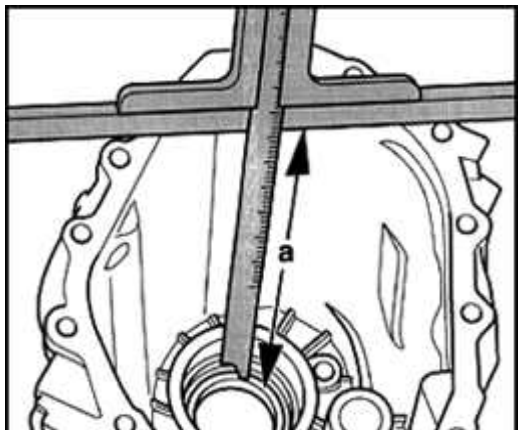
39-49

Re-determining "S4" after replacing transmission cover

Special tools and equipment

- VW387 dial gauge holder
- VW792/1 assembly tool
- Dial indicator
- Dial indicator extension
- Depth gauge with minimum 5/100 mm precision

- Clean housing mating surfaces.



- Measure difference in depth "a" on old and new transmission cover.

Example:

	Depth -a- (old transmission cover)	257.40 mm
	Depth -a- (new transmission cover)	257.55 mm
=	Difference	0.15 mm

- Install thicker shim "S4" if new transmission cover is deeper.

- Install thinner shim "S4" when the old transmission cover is deeper.

Example:

	Previous shim "S4"	0.95 mm
+	Difference	0.15 mm
=	New shim "S4"	1.10 mm

Available shims ⇒ Page 39-47 , table

- Install tapered roller bearing outer race with shim "S4" into transmission cover ⇒ Fig. 8 , ⇒ Page 35-32 .

- Install fully assembled pinion shaft into transmission housing.

- Install transmission cover and tighten to 22 Nm (16 ft lb).

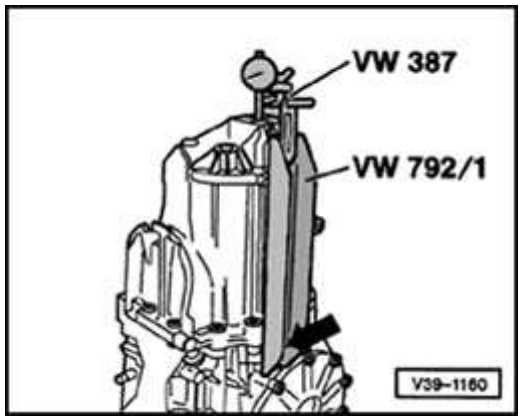
39-51

Preload for tapered roller bearing for pinion shaft, checking

- Turn pinion shaft 5 rotations in each direction to seat the tapered roller bearing.

Note:

The pinion shaft can be turned by simultaneously turning both drive flanges.



- Install measuring tools and secure to transmission housing with bolt (arrow).
- Attach dial indicator (3 mm measuring range) to center of transmission cover and set to 0 with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft.

  If correct shims have been selected, the dial indicator will now indicate the following value: 0.05-0.15 mm.
- Remove measuring tools.
- Coat sealing surfaces with thin layer of sealant AMV 188 001 02.
- Tighten transmission cover bolts to 22 Nm (16 ft lb).

39-52

Ring gear, adjusting

Adjusting differential

For a list of the repairs which will require the ring gear to be adjusted ⇒ Page 39-33 , List of adjustments

Special tools and equipment

- VW382/10 dial indicator extension
- VW385/17 magnetic plate
- VW387 dial gauge holder
- VW388 measuring lever
- VW402 thrust plate
- VW408A punch
- VW472/1 pressure piece
- VW521 adjustment tool
- 3177 clamp

- Torque gauge 0-600 Ncm
- Dial indicator
- Dial indicator extension 30 mm

39-53

Determining total shim thickness Stotal for shims S1 + S2

(Adjust preload of tapered roller bearing for differential)

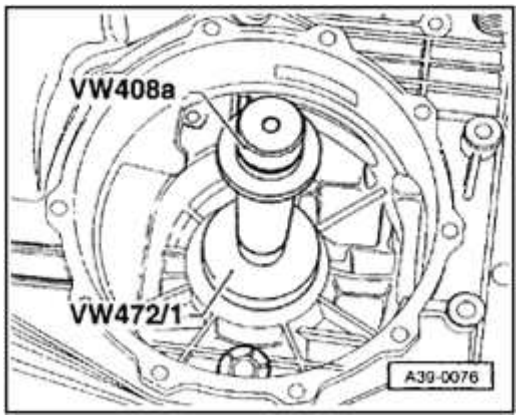
- Pinion shaft removed

Note:

If only the differential tapered roller bearings are to be replaced, remove ring gear from differential housing. The pinion shaft does not have to be removed.

- Remove seals and outer races from both tapered roller bearings for differential.

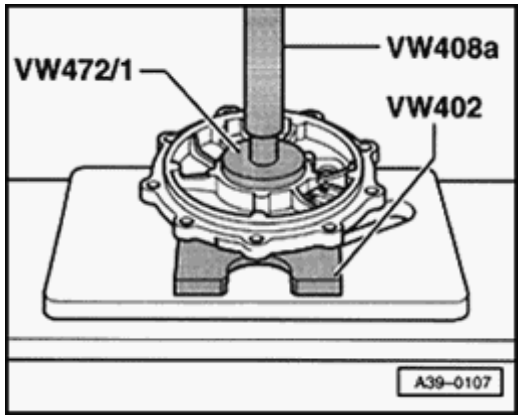
- Remove shims ⇒ Page 39-15 .



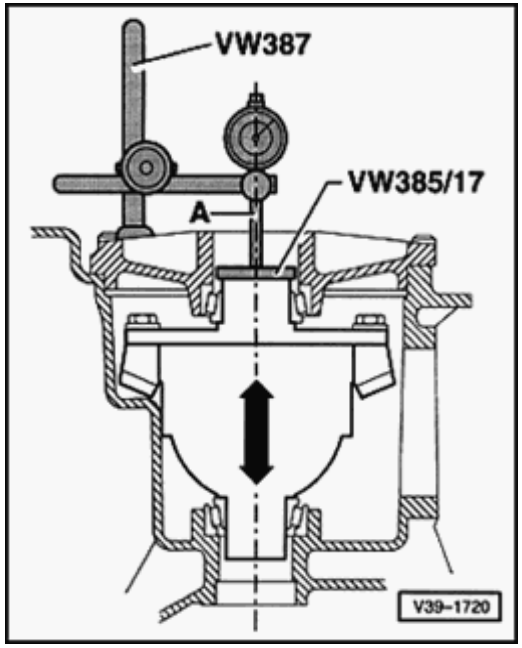
- Drive in tapered roller bearing outer race together with shim S2 into transmission housing ⇒ Fig. 3, ⇒ Page 39-23 . Use shim "S2*" with 1.20 mm thickness for measurement purposes (2 shims with 0.60 mm).

Note:

A shim S2 with a thickness of 1.20 mm is installed for initial measurement. It is referred to in the following text as S2. After determining backlash, S2* is replaced with the appropriate shim S2.*



- Press in tapered roller bearing outer race into differential cover without shim S1 ⇒ Fig. 9 , ⇒ Page 39-26 .
- Install differential into transmission housing without Vehicle Speed Sensor (VSS) -G22- gear drive. Ring gear is located on left side in front of final drive cover.
- Install cover for differential and tighten four bolts to 25 Nm (18 ft lb).
- Position transmission so that cover for differential faces upward.
- Turn differential 5 rotations in each direction to seat tapered roller bearing.



- Assemble measuring equipment, use 30 mm dial indicator extension.
- Set dial indicator (3 mm measuring range) -A- to 0 with 2mm preload.

Note:

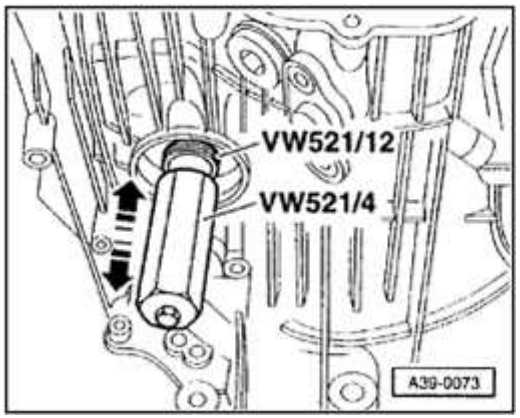
Tip of dial indicator must be positioned on the center of the differential.

39-55

- Lift differential without turning it, read play on dial indicator and note.

Dimension in the following example: 0.62 mm

Notes:



- *To lift differential, secure VW521/4 locking sleeve and VW521/8 bushing (for transmissions without polygon bearing) or VW521/12 (for transmissions with polygon bearing) to right side of differential (housing side).*
- *If measurement has to be repeated, turn differential again 5 rotations in both directions to seat tapered roller bearing.*

Formula:

"Stotal" = "S2*" + measured value + bearing preload

Example:

	Installed shim "S2*"	1.20 mm
+	Dimension	0.62 mm
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness "Stotal" for "S1 + S2"	
		2.12 mm

39-56

Determining thickness of shim "S1*"

Notes:

- *"S1*" is used for the initial measurement. After determining backlash, "S1*" is replaced with final shim "S1."*
- *The total shim thickness "Stotal" remains unchanged.*

Formula:

"S1*" = "Stotal" - "S2*"

Example:

	Total shim thickness "Stotal" for "S1" + "S2"	2.12 mm
-	Installed shim "S2*"	1.20 mm
=	Thickness of shim "S1*"	0.92 mm

39-57

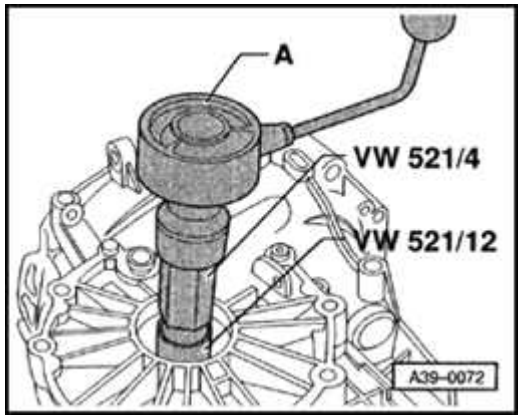
Measuring friction torque (check measurement)

Notes:

- *Tapered roller bearings for differential are low-friction. Measurement of friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "Stotal."*

- *Do not lubricate new tapered roller bearings for measuring friction torque. The bearings have already been treated by a special oil by the manufacturer.*

- Pinion shaft removed



- Install torque gauge 0-600 Ncm -A- on differential.
- Read friction torque.

Friction torque specified values:

New bearings	Used bearings
200 - 350 Ncm	30 - 60 Ncm

Note:

For a readjustment of the gear set, the pinion shaft adjustment should now be checked ⇒ Page 39-35 .

39-58

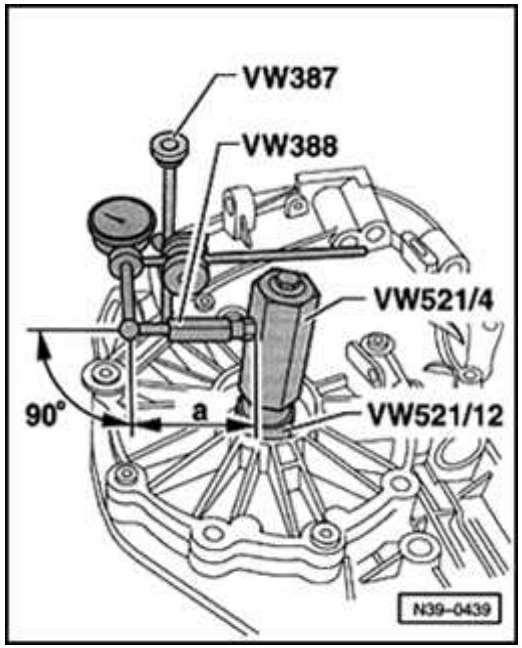
Measuring backlash

(Position of ring gear in transmission housing)

- Pinion shaft with shims "S3*" and "S4*" installed

- Install differential.

- Turn differential 5 rotations in each direction to seat tapered roller bearing.



- Secure VW387 dial gauge holder on housing.
- Install VW521/4 locking sleeve and VW521/8 bushing (for transmissions without polygon bearing) or VW521/12 (for transmissions with polygon bearings).
- Install dial indicator with VW382/10 extension pin, 6 mm.
- Set VW388 measuring lever to dimension "a:"

Dimension "a"	Ring gear diameter
67 mm	170 mm
72 mm	180 mm

39-59

- Determine play between teeth flanks as follows:

  - Turn ring gear until it contacts a tooth flank (end of backlash travel).

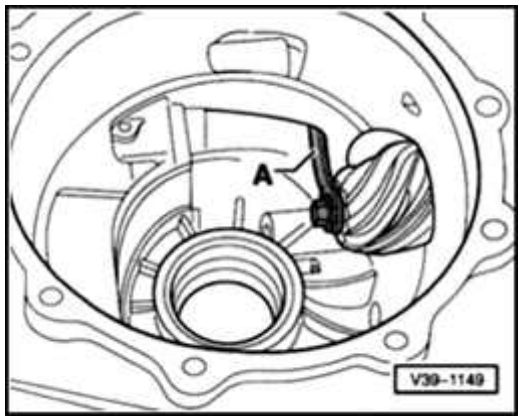
  - Set dial indicator to 0 with 2 mm preload.

  - Turn ring gear back until it contacts opposite tooth flank (backlash).

  - Read backlash and note.

  - Turn ring gear another 90° and repeat measurement 3 times.

Notes:



- *If pinion shaft turns when turning differential, install 3177 clamp -A- so that an exact backlash measurement can be made.*
- *Loosen clamping piece to turn the ring gear further.*
- *Differential must be installed with cutout for differential bevel gears facing pinion shaft.*

- If 3177 clamp is installed, install differential 180° to final position and repeat measurements.

Determining average backlash

- Add four measured values together and divide total by 4 to determine average.

Example:

	1st Measurement	0.28 mm
+	2nd Measurement	0.30 mm
+	3rd Measurement	0.30 mm
+	4th Measurement	0.28 mm
=	Total of measurements	1.16 mm

- Result: the average backlash is 1.16 mm ÷ 4 = 0.29 mm

Note:

If the measured values differ more than 0.06 mm from each other, the installation of ring gear or gear set itself may not be correct. Check installation and replace gear set if necessary.

39-61

Determining thickness of shim "S2"

Formula:

"S2" = "S2*" - backlash + lift

Example:

	Installed shim "S2*"	1.20 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim "S2"	1.06 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

Available shims for "S2"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using shim tolerances it is possible to find the exact shim thickness required; insert two shims if necessary.

39-62

Determining thickness of shim "S1"

Formula:

"S1" = "Stotal" - "S2"

Example:

	Total shim thickness "Stotal" for "S1 + S2"	2.12 mm
-	Thickness of shim "S2"	1.06 mm
=	Thickness of shim "S1"	1.06 mm

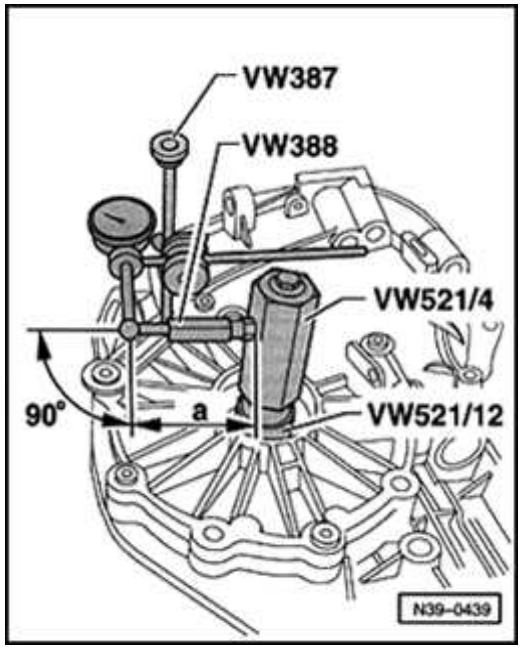
- Determine shim(s) according to table. Part numbers ⇒ parts catalog

Available shims for "S1"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using shim tolerances it is possible to find the exact shim thickness required; insert two shims if

necessary.



Checking measurement

- After installing shims "S1" and "S2," turn differential 5 rotations in each direction to seat tapered roller bearings.

Note:

For transmissions without polygon bearing, use VW521/8 bushing instead of VW521/12 shown.

- Measure backlash 4 times on circumference.

  Specification: 0.12-0.22 mm

Notes:

- *If backlash lies outside tolerance, repeat adjustments. Do not change total shim thickness "Stotal."*
- *The individual measurements must not vary more than 0.06 mm from each other.*

Drive pinion and ring gear, adjusting

Note:

- *Careful adjustment of the drive pinion and ring gear is important for the service life and smooth running of the final drive. For this reason, the drive pinion and ring gear are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*

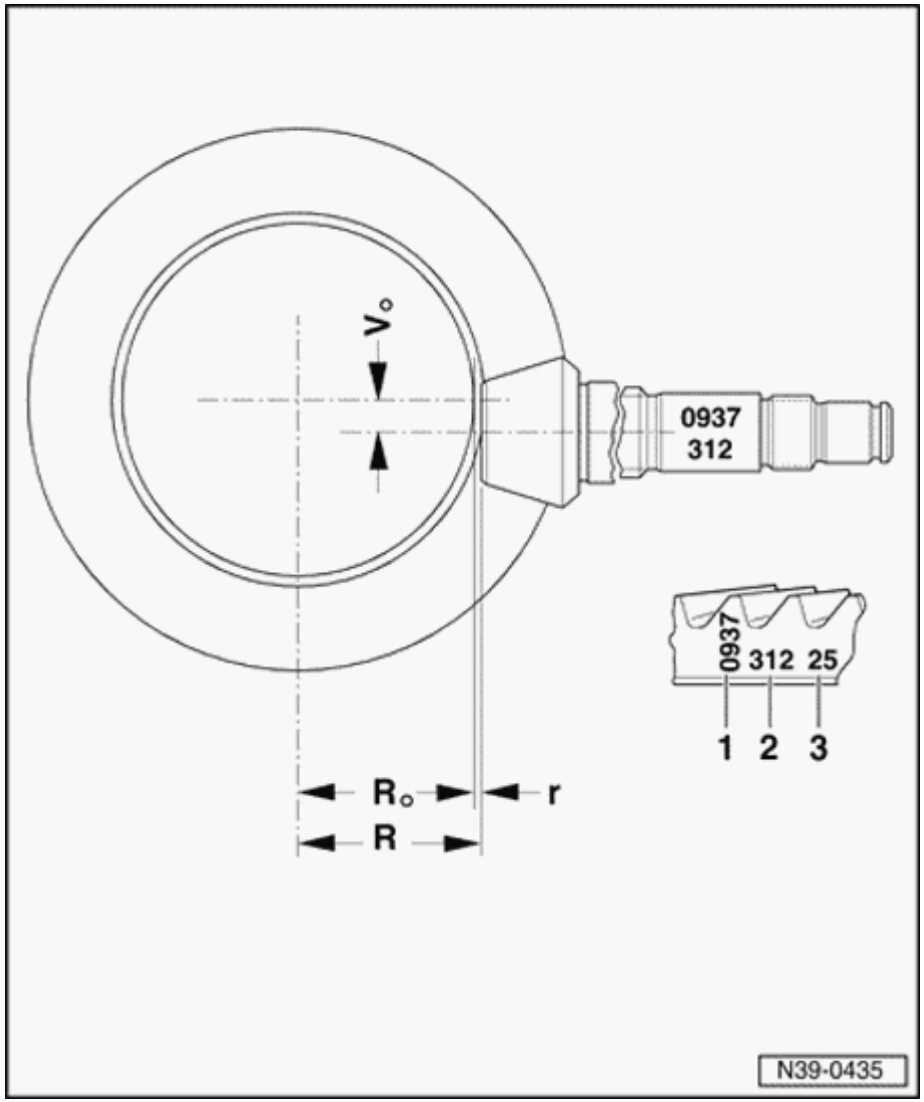
- *The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production.*

- *The deviation (tolerance) "r," which is related to the master gauge "Ro," is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (drive pinion and ring gear) may only be replaced together as a matched pair.*

- *Observe the general repair instructions for*

tapered roller bearings and shims.

- *The frictional torque measurement is only used as a final check to make sure that the adjustment is correct.*



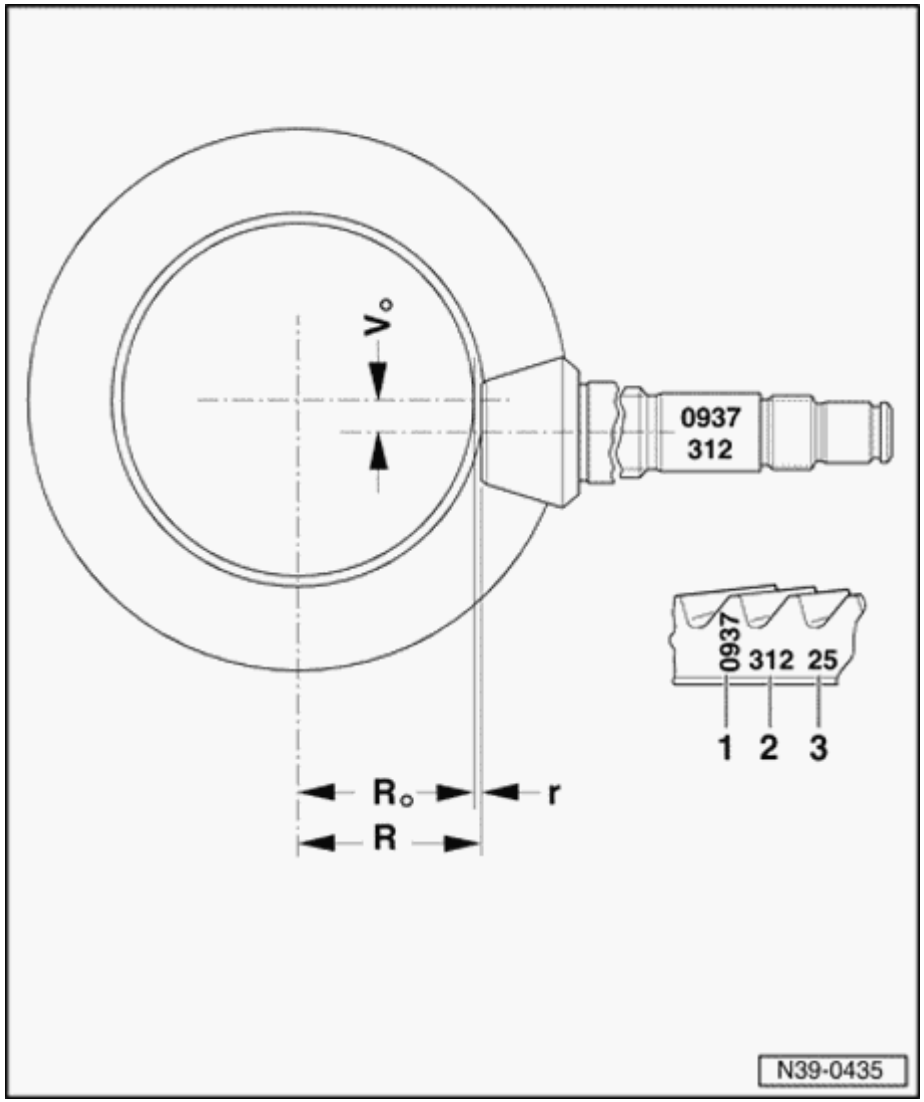
Gear sets, adjusting and marking

1 - Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.

2 - Pairing number (312) of final drive set.

3 - Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies r = 0.25 mm

Ro - Length of master gauge used on test machine Ro = 59.65 mm



R - Actual distance between ring gear axis and face of drive pinion at point with quietest running for this gear set R = Ro + r

Vo - Hypoid offset

Final drive set readjusting, recommended sequence

The following sequence of work is recommended to save time when the drive pinion and ring gear have to be adjusted:

1.) Determine total shim thickness "S_{total}" for "S1" +"S2" (sets preload for tapered roller bearings for differential) ⇒ from Page 39-54 .

2.) Determine total shim thickness "S_{total}" for "S3" + "S4" (sets preload for tapered roller bearings for drive pinion) ⇒ from Page 39-41 .

3.) Distribute total shim thickness "S_{total}" for "S3" + "S4" so that the distance from center of ring gear to face of drive pinion is the same as distance "R" which was determined during production ⇒ from Page 39-47 .

4.) Distribute total shim thickness "S_{total}" for "S1" + "S2" so that the specified backlash between ring gear and drive pinion is maintained ⇒ from Page 39-61 .

Note:

Overview of components and shims ⇒ Page 39-38 .

Adjustment overview

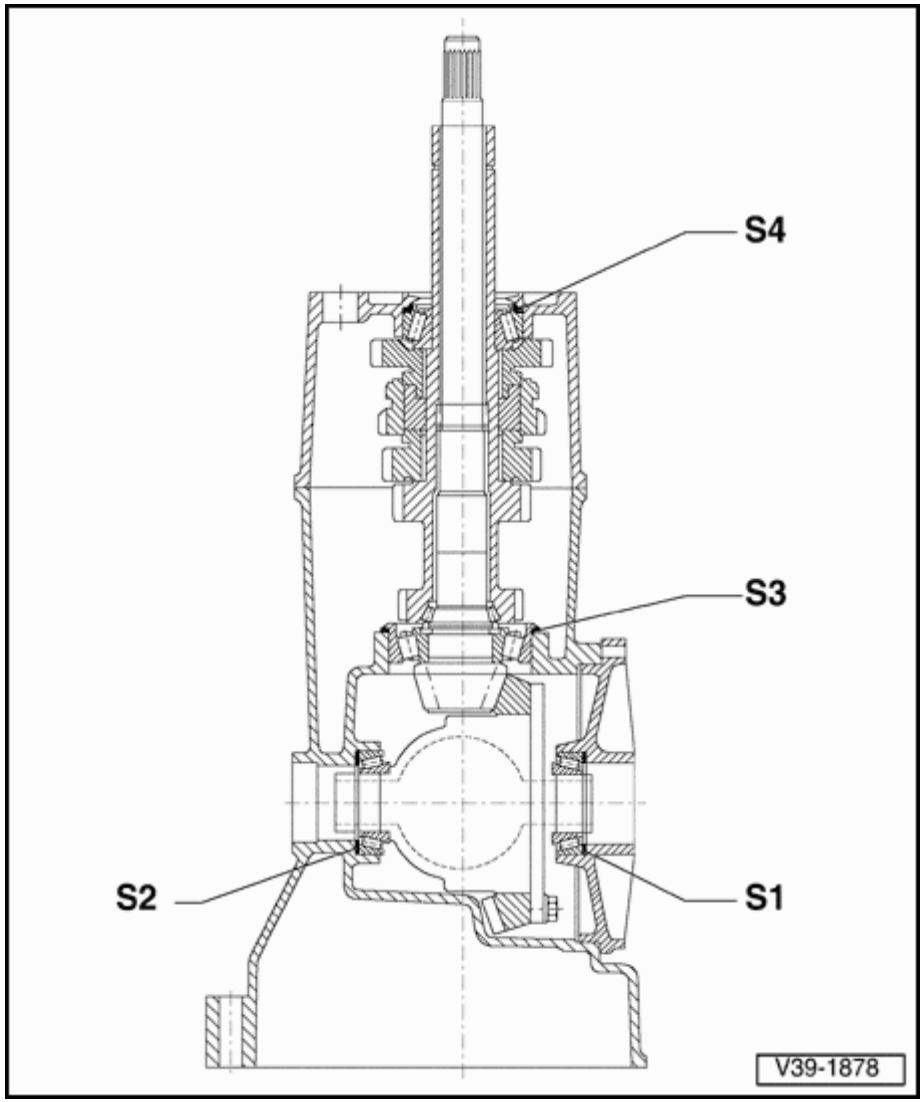
Note:

If repairs have been carried out to the transmission, it is only necessary to adjust the drive pinion, ring gear or final drive set if components have been replaced which have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:

Parts replaced: ▼	**adjustment required:**			
	Ring gear "S1"+"S2" 1) ⇒ Page 39-52	Drive pinion "S3"+"S4" 1) via deviation "r" ⇒ Page 39-39	Drive pinion "S4" 1) ⇒ Page 34-121	Backlash Check ⇒ Page ⇒ Page 39-59
Transmission housing	X	X		X
Bearing plate			X	X
Differential housing	X			X
Tapered roller bearing for drive pinion		X		X
Tapered roller bearing for differential	X			X
Final drive set 2)	**X**	X		X
Hollow shaft			X	X
Cover for differential	X			X

1) Shims; installation position ⇒ Page 39-38 .

2) Drive pinion and ring gear; only replace together.



Shims, position

Note:

Adjustment overview when replacing individual components of transmission ⇒ *Page 39-37* .

S1 - Adjustment shim for ring gear in cover for differential

S2 - Adjustment shim for ring gear in transmission housing

S3 - Adjustment shim for drive pinion in transmission housing

S4 - Adjustment shim for drive pinion in bearing plate

Front final drive ring gear and pinion shaft, adjusting

Notes:

- *Careful adjustment of the pinion shaft and ring gear is essential for the service life and smooth running of the final drive. For this reason, the pinion shaft and ring gear are matched together during manufacturing, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the pinion shaft in an axial direction and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*

- *The objective of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine during production.*

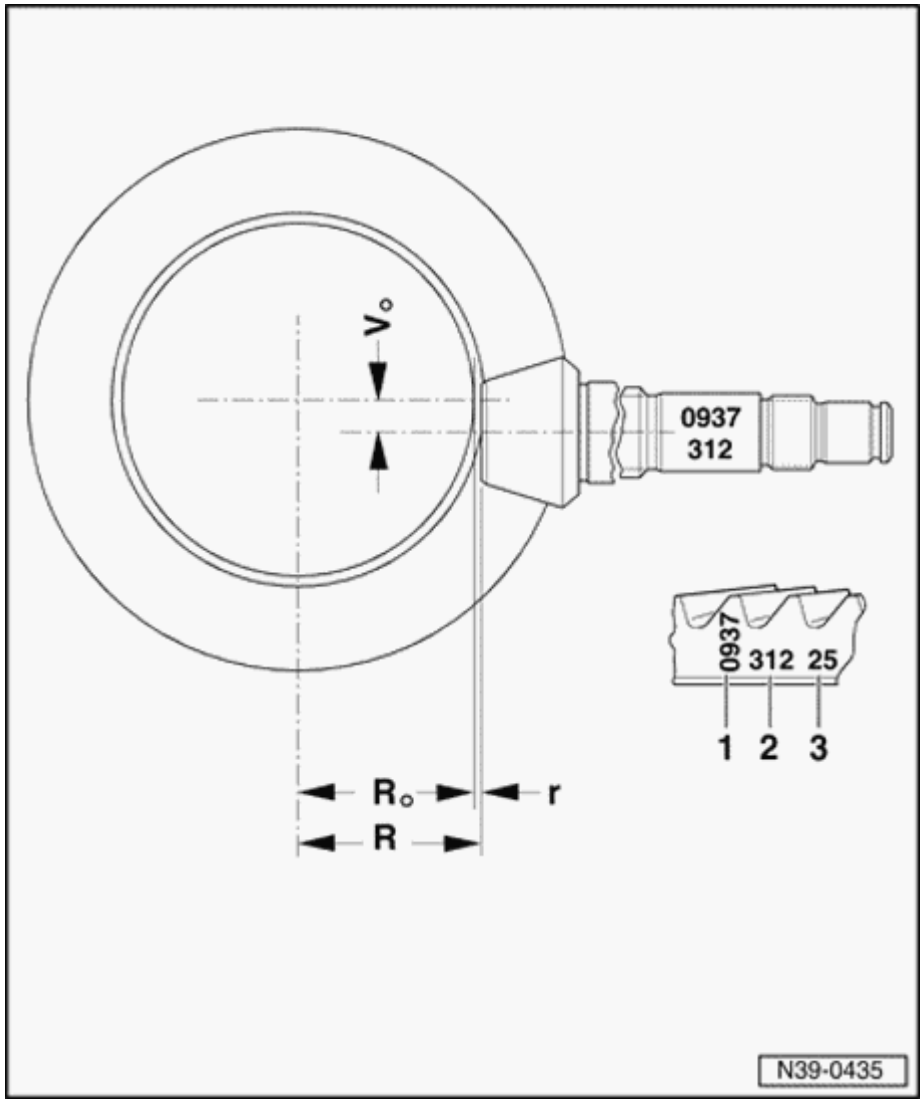
- *The deviation, or tolerance "r", which is based on the master gauge "Ro", is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (pinion shaft and ring gear) must only be replaced together as a matched pair.*

- *Observe the general repair instructions for*

tapered roller bearings and shims.

- *The friction torque measurement only serves to give a final check of the adjustment.*

39-35



Adjustment and marking of final drive gear sets

1 - Identification "0937" signifies an Oerlikon gear set with a ratio of 37:9

2 - Pairing number (312) of final drive gear set

3 - Deviation (tolerance) "r" is based on the test machine master gauge used during production. The deviation "r" is always given in 1/100 mm. Example: 25 signifies r = 0.25 mm

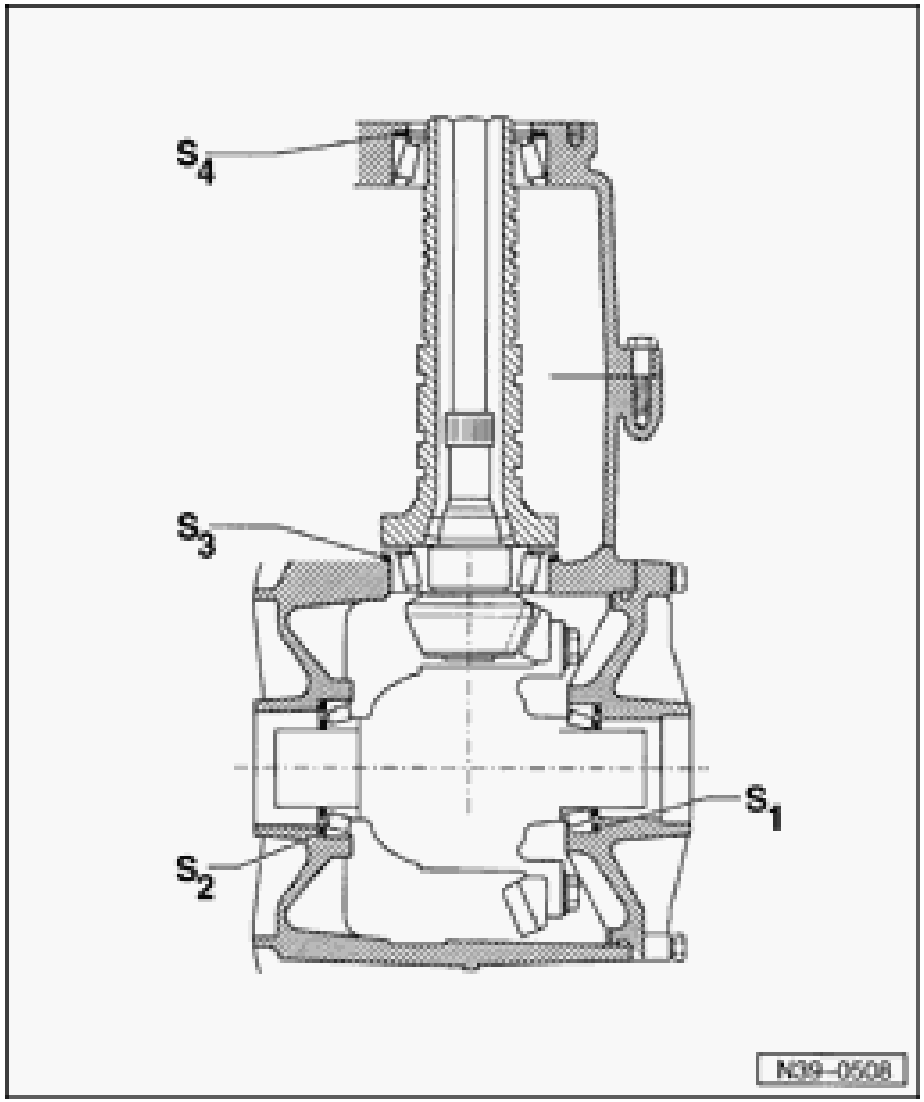
Ro - Length of test machine master gauge used

Ro - For 170 mm (6.69 in.) diameter ring gear = 54.95 mm (2.16 in.)

R - Actual dimension between ring gear axis and face of pinion shaft in position of quietest running for this gear set.

Vo - Hypoid offset

39-36



Installation position of shims

Note:

List of adjustments when replacing individual components of transmission ⇒ *Page 39-37* .

S1 - Shim for ring gear in differential cover

S2 - Shim for ring gear in transmission housing

S3 - Shim for pinion shaft in transmission housing

S4 - Shim for pinion shaft in transmission cover

39-37

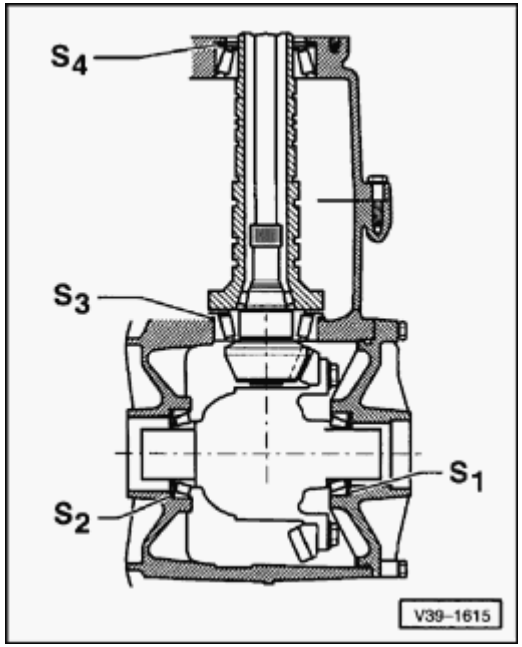
List of adjustments

Note:

If repairs have been carried out on the transmission, it is only necessary to adjust the pinion shaft, ring gear or final drive set if components have been replaced that have a direct effect on the adjustment of the final drive. Refer to the following table to avoid unnecessary adjustments:

Component to be adjusted: **Component to be adjusted:**	Ring gear (S1 + S2)1) ⇒ Page 39-57	Pinion shaft (S3 + S4)1) via deviation "r" ⇒ Page 39-39	Pinion shaft (Shim S4)1) ⇒ Page 39-54	Backlash measurement ⇒ Page 39-63
Transmission housing3)	X	X		X
Transmission cover			X	
Differential housing	X			X
Double tapered roller bearing for pinion shaft and hollow shaft		X		X
Tapered roller bearing for differential	X			X
Final drive set2)	**X**	X		X
Differential cover	X			X

1) Shims, installation position ⇒ Page 39-36 .
2) Pinion shaft and ring gear, only replace together.
3) If the transmission housing is replaced, the input shaft must also be adjusted ⇒ input shaft, adjusting, ⇒ Page 35-17 .



Final drive gear set, recommended sequence for re-adjusting

If the pinion shaft and ring gear have to be readjusted, the following sequence is recommended for maximum efficiency:

1.) Determine total shim thickness Stotal for S1 + S2 (adjusting preload for tapered roller bearings for differential) ⇒ Page 39-58 .

2.) Determine total shim thickness Stotal for S3 + S4 (preload for tapered roller bearings for pinion shaft) ⇒ Page 39-41 .

3.) Distribute total shim thickness Stotal for S3 + S4 so that the dimension from center of ring gear to face of pinion shaft is the same as dimension "r" which was determined during production ⇒ Page 39-49 .

4.) Distribute total shim thickness Stotal for S1 + S2 so that the specified backlash between ring gear and pinion shaft is maintained ⇒ Page 39-65 .

Note:

Overview of components and shims ⇒ Page 39-36 .

Pinion shaft, adjusting

(Adjusting pinion shaft and hollow shaft)

Adjustment of the pinion shaft is only necessary if the gear set, tapered roller bearing for the pinion shaft, or the transmission housing has been replaced ⇒ table, ⇒ Page 39-37 .

Special tools and equipment

- VW296 removal tool
- VW385/1 measuring bar
- VW385/3 centering disc (2x)
- VW385/14 measuring rod
- VW385/17 magnetic plate
- VW385/30 master gauge-adjustable
- VW385/33 end gauge
- VW387 dial indicator holder

- VW401 thrust plate
- VW407 punch
- VW519 sleeve

39-40

- VW792 installation arbor
- 3062 thrust pad
- 3182 sleeve
- Torque gauge 0-600 Ncm (53 in. lb)
- Dial indicator
- Dial indicator extension 6.5 mm
- Dial indicator extension 30 mm

Drive pinion, adjusting

(Adjusting drive pinion and hollow shaft)

Repairs after which the drive pinion must be adjusted ⇒ Page 39-37 , table

Special tools, testers and auxiliary items

- Universal mandrel VW 385/1
- Centering disc VW 385/2
- Centering disc VW 385/3
- Measuring plunger VW 385/14
- Measuring plate VW 385/17
- Master gauge VW 385/30
- Universal dial gauge bracket VW 387
- Press tool VW 407
- Multi-purpose tool VW 771/15

- Thrust pad 3062
- Pin 3114/2

39-40

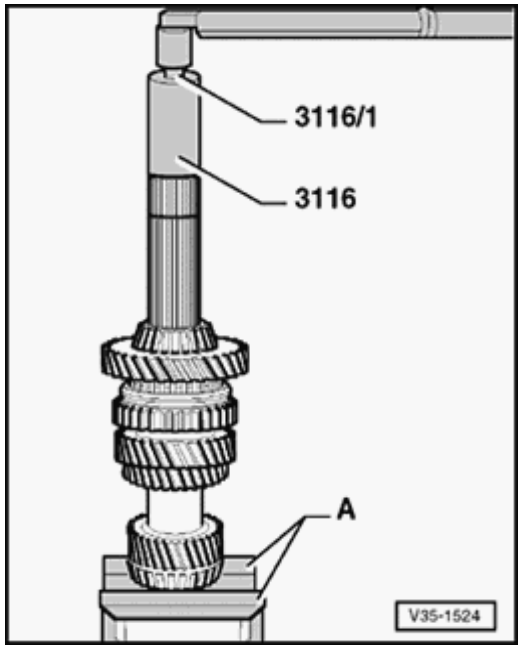
- Clamping sleeve 3116
- Bolt 3116/1
- Torque gauge 0-600 Ncm
- Dial gauge
- Dial gauge extension 6.5 mm
- Dial gauge extension 30 mm

39-41

Determining total shim thickness "S_{total}" for shims "S3" + "S4"

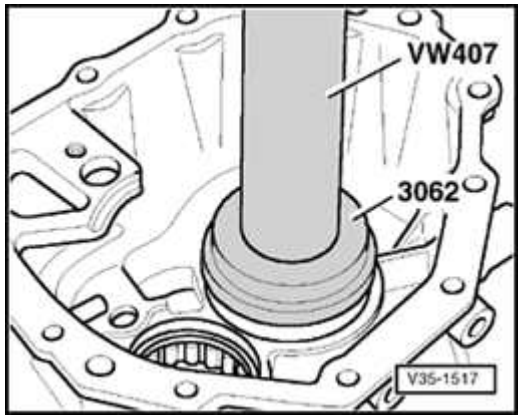
(Setting preload of tapered roller bearing for drive pinion with hollow shaft)

- Differential removed



- Clamp drive pinion in a vice using clamps -A-.
- Insert tapered rollers with grease, assemble drive pinion and hollow shaft.
- Turn hollow shaft against drive pinion five turns in both directions so that tapered roller bearings settle.
- Preload drive pinion/hollow shaft to 10 Nm, hold hollow shaft when doing this.
- Insert outer race for tapered roller bearing for drive pinion into transmission housing without shims ⇒ *Fig. 2* , ⇒ Page 35-22 and ⇒ *Fig. 3* , ⇒ Page 35-23 .

39-42

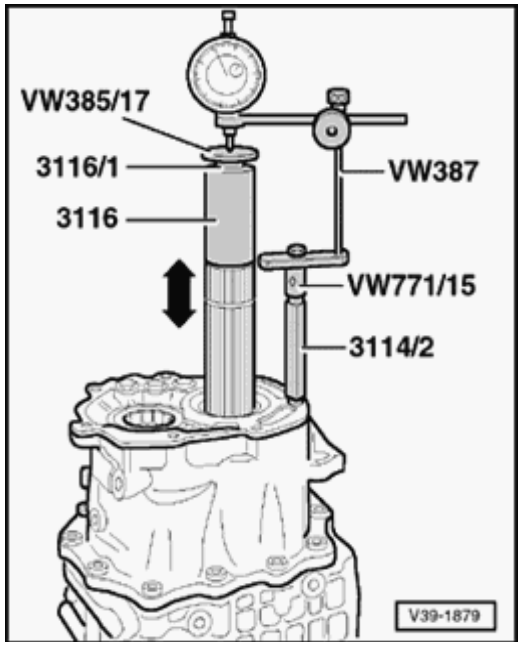


- Insert outer race for tapered roller bearing for drive pinion with shim "S4*" (1.0 mm thick) into bearing plate.

Note:

For measurement purposes a shim "S4" of 1.0 mm is initially inserted which is designated "S4" After determining measurement "e" "S4*" will be replaced by the correct shim "S4."*

- Insert completely assembled drive pinion in transmission housing.
- Fit bearing plate with dowel sleeves and tighten to 25 Nm.
- Turn drive pinion with hollow shaft five turns in both directions so that tapered roller bearings settle.



- Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

Note:

The tip of the dial gauge must be positioned on center of drive pinion.

- Lift drive pinion, without turning, and read off play on dial gauge.

  Measurement in example: 0.90 mm

Note:

If the measurement has to be repeated, the drive pinion with hollow shaft must be turned 5 turns in each direction to settle the tapered roller bearings. Set dial gauge again to "0" with 2 mm preload.

Formula:

"S_{total}" = "S4*" + measurement + bearing preload

Example:

	Inserted shim "S4*"	1.00 mm
+	Measured value (example)	0.90 mm
+	Bearing preload (constant)	0.15 mm
=	Total shim thickness "S_{total}" for "S3" + "S4"	2.05 mm

Determining thickness of shim "S3*"

Formula:

"S3*" = "S_{total}" - "S4*"

Example:

	Total shim thickness "S_{total}" for "S3" + "S4"	2.05 mm
-	Inserted shim "S4*"	1.00 mm
=	Thickness of shim "S3*"	1.05 mm

Remove outer race for tapered roller bearing, insert shim "S3*" into transmission housing and install outer race again

⇒ *Fig. 2* , ⇒ Page 35-22 and

⇒ *Fig. 3* , ⇒ Page 35-23 .

- Insert completely assembled drive pinion into transmission housing again.

- Fit bearing plate with dowel sleeves and tighten securing bolts to 25 Nm.

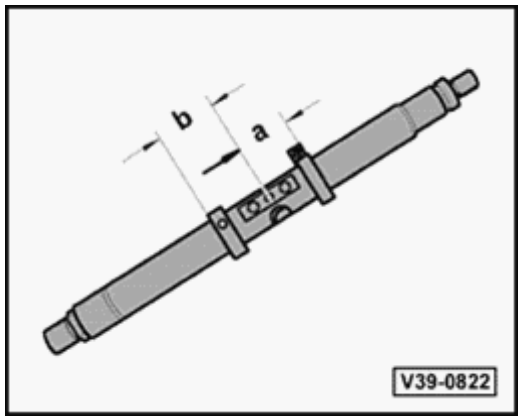
- Turn drive pinion with hollow shaft five turns in both directions to settle the tapered roller bearing.

39-45

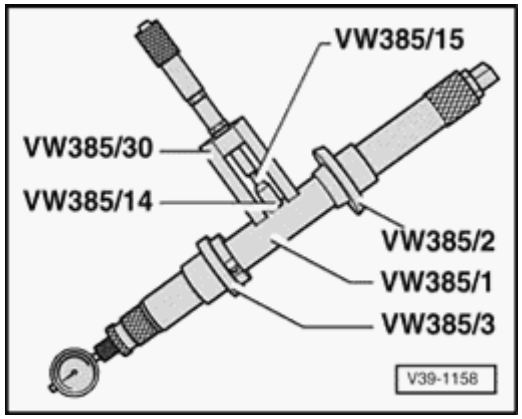
Determining measurement "e"

Note:

Measurement "e" is required to determine the final shim thickness of "S3" and "S4."



- Set adjustment rings of universal mandrel VW 385/1 to the following measurements:
  - Dimension a = 65 mm
  - Dimension b = 55 mm

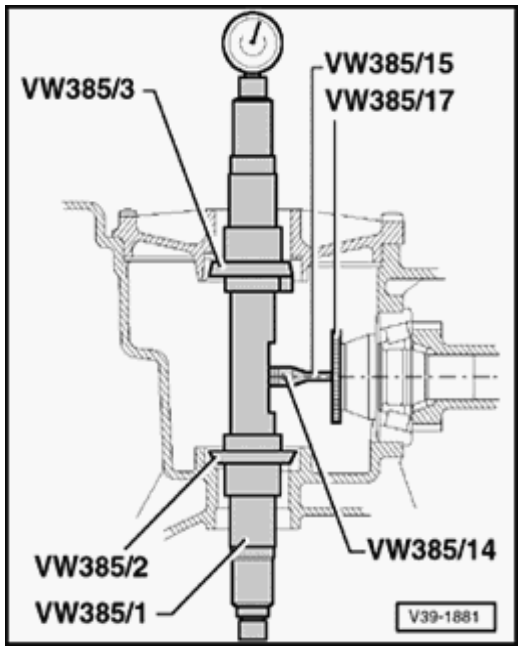


- Assemble universal mandrel VW 385/1 as illustrated:
  - Dial gauge extension VW 385/15, 9.3 mm long
  - Master gauge VW 385/30
- Set master gauge VW 385/30 to Ro = 59.65 mm and fit onto mandrel.
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

39-46

Note:

The gauge VW 385/27 can also be used in place of the master gauge VW 385/30 (Ro = 59.65 mm).



Arrangement of measuring equipment when determining dimension "e"

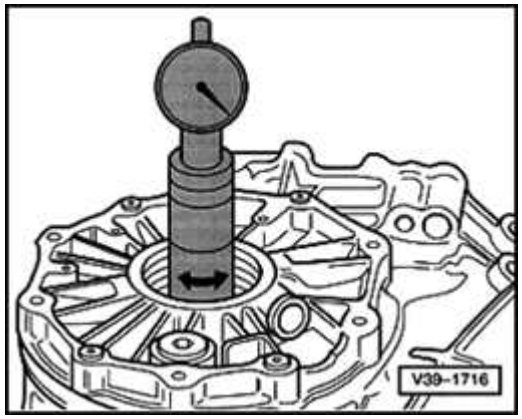
- Place end measuring plate VW 385/17 onto drive pinion head.

Note:

Ensure plate contact surface fits exactly and is free of oil.

- Take master gauge off mandrel.
- Insert mandrel into transmission housing.
  - ♦ The centering disc 385/3 faces toward cover for final drive
- Fit cover for final drive and tighten 4 bolts to 25 Nm.
- Using adjustable ring, pull 2nd centering disc VW 385/2 out as far as possible so that mandrel can still just be turned by hand.

39-47



- Turn mandrel until dial gauge plunger tip touches end measuring plate on drive pinion head, then measure maximum deflection (return point).
  - Measurement in following example: "e" = 0.16 mm (in red scale)

Determining thickness of shim "S3"

Formula:

"S3" = "S3*" + "r" + "e"

("e" in black scale)

or

"S3" = "S3*" + "r" - "e"

("e" in red scale)

Note:

- *The deviation "r" related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and inscribed on outer circumference of ring gear.*
- *If measurements are obtained on red scale then subtract value "e."*
- *If measurements are obtained on black scale then add value "e."*

Example:

	Inserted shim "S3*"	1.05 mm
+	Deviation "r"	0.38 mm
-	Determined "e" (in red scale)	
		0.16 mm
=	Thickness of shim "S3"	1.27 mm

- Determine shim(s) from table.

⇒ *Parts catalog*

The following shims are available for "S3"

Shim thickness (mm) [1)]		
0.45	0.60	0.75
0.50	0.65	
0.55	0.70	

[1)] Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-49

Determining thickness of shim "S4"

Formula:

"S4" = "S_{total}" - "S3"

Example:

	Total shim thickness "S_{total}" for "S3" + "S4"	2.05 mm
-	Thickness of shim "S3"	1.27 mm
=	Thickness of shim "S4"	0.78 mm

- Determine shim(s) from table.

⇒ *Parts catalog*

The following shims are available for "S4"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

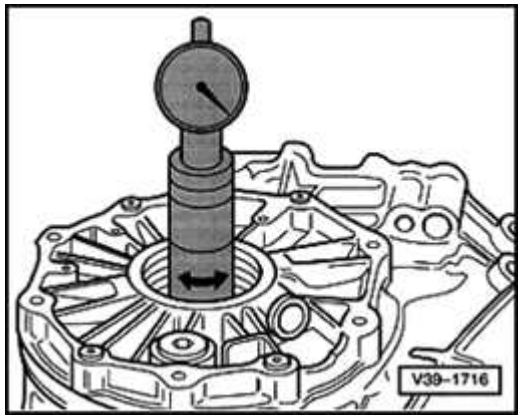
[1)] Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-50

Performing check measurement

Checking dimension "r"

- Install drive pinion with determined shims "S3" and "S4" and turn 5 turns in both directions.



- Insert universal mandrel, ⇒ Page 39-45 , "determining measurement 'e'" and perform check measurement.
- Read off dial gauge anti-clockwise (red scale).
  - ♦ If the shims have been correctly selected, the deviation "r" (marked on outer circumference of ring gear) must be shown - within a tolerance of ± 0.04 mm

Note:

Then, (after removing universal mandrel) check again that the dial gauge, with master gauge VW 385/30 in place, indicates "0" with 2 mm preload, otherwise correct adjustments.

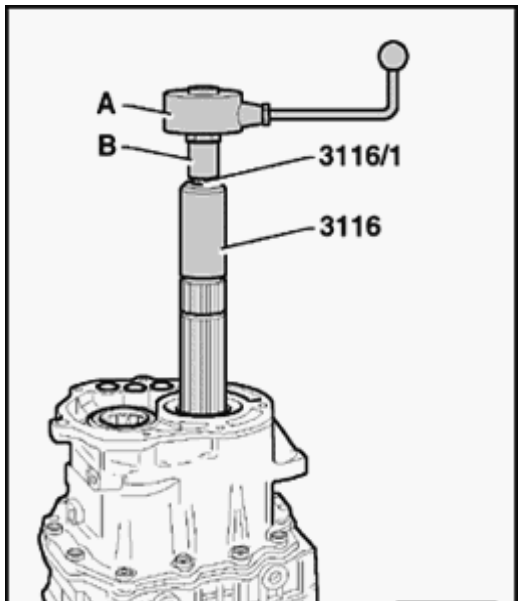
39-51

Measuring friction torque (check)

Note:

- *Drive pinion/hollow shaft tapered roller bearings are low friction bearings. Therefore the frictional torque has only a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "S_{total}."*

- *Do not additionally oil new tapered roller bearing to perform the frictional torque measurement. These bearings have already been treated with a special oil by the manufacturer.*



- Fit torque gauge 0-600 Ncm -A- onto drive pinion.

B - Socket

- Insert tensioning sleeve 3116.

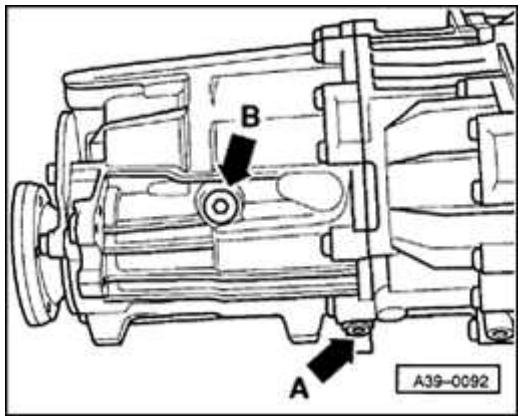
Frictional torque specification:

New bearings	Used bearings
80-150 Ncm	30-60 Ncm

39-40

Gear oil in center differential

Gear oil in center differential, checking and topping off



- If necessary, loosen or remove relevant parts of the exhaust system to gain access to oil filler plug (arrow B):

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Remove oil filler plug (arrow).
  - ♦ Specification: Oil level should reach lower edge of oil filler hole.
- If necessary, top up gear oil. Specification ⇒ page 00-24 .
- Always replace oil filler plug.
- Install new oil filler plug.
- Secure or re-install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

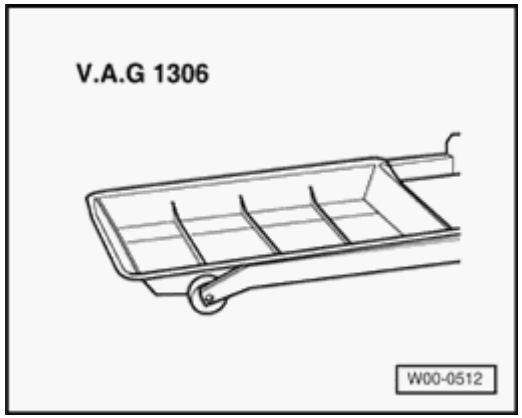
Tightening torque

Component	Nm
Oil filler plug	35

39-41

Gear oil in center differential, changing or topping off after repair

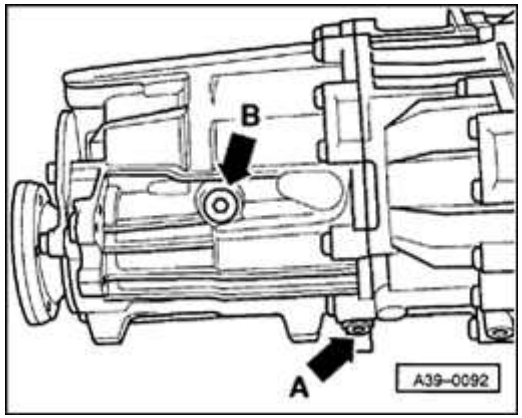
Special tools and equipment



- VAG1306 drip tray

Draining gear oil

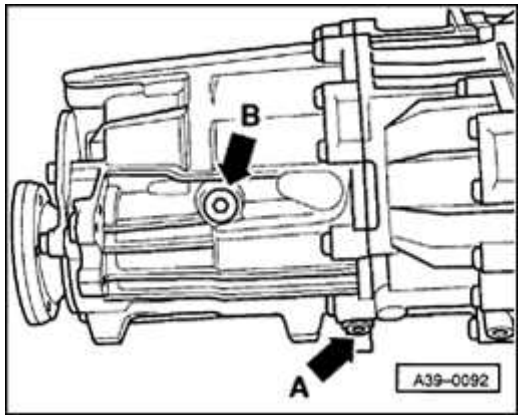
- Place VAG1306 drip tray underneath.



- Removing drain plug (arrow A) and draining gear oil.
- Always replace drain plug.
- Install new drain plug (arrow A) again.

39-42

Filling up gear oil



- If necessary, loosen or remove relevant parts of the exhaust system to gain access to oil filler plug (arrow B):

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

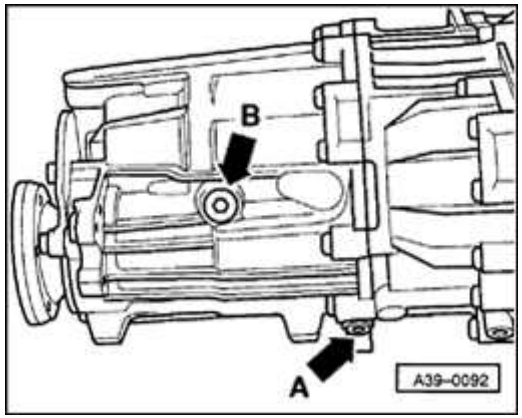
Note:

There is a distinction made between two cases:

-A Center differential was not removed

-B Center differential was removed

A - Center differential was not removed (e.g. after removing and installing drive flange)



- Remove oil filler plug (arrow B).
- Top up transmission fluid to lower edge of oil filler hole. Specification and capacity ⇒ page 00-24 .
- Install old oil filler plug.

Note:

If it was necessary to loosen or remove the exhaust system, this must be re-secured or re-installed for the road test. It must be removed and installed again for the final oil level check.

39-43

- Road test vehicle (15 minutes pure driving).

Note:

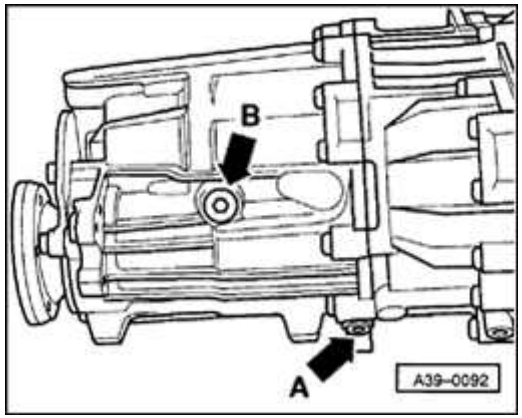
During road test, gear oil will enter output cover and Torsen differential; oil level in center differential housing will drop.

- Fill transfer housing with gear oil and check oil level ⇒ page 39-40 .

B - Center differential was removed and disassembled

- Add 200 ml. gear oil to output cover.

- Assemble center differential and install ⇒ page 39-58 .



- Remove oil filler plug (arrow B).
- Add 600 ml. gear oil to center differential housing.
- Always replace oil filler plug.
- Install new oil filler plug.

Note:

Oil level does not need to be re-checked.

All:

- Secure or re-install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

Tightening torques

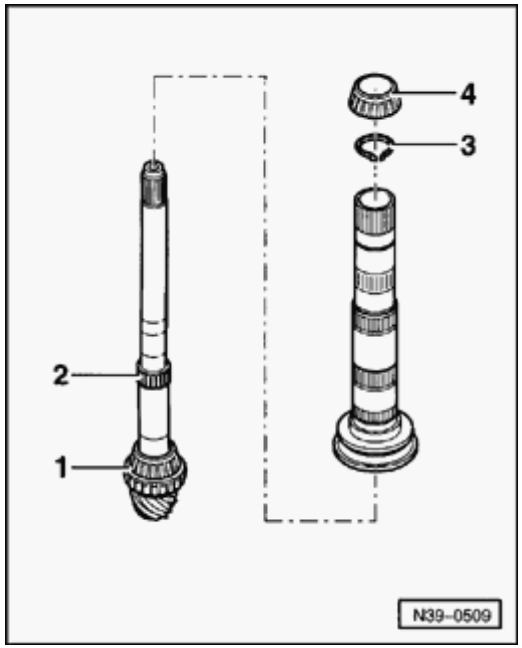
Component	Nm
Oil drain plug	20
Oil filler plug	35

Speedometer Vehicle Speed Sensor (VSS), removing and installing

Total shim thickness Stotal for shim S3 + S4, determining

Adjust preload of tapered roller bearings for pinion shaft with hollow shaft

- Differential removed

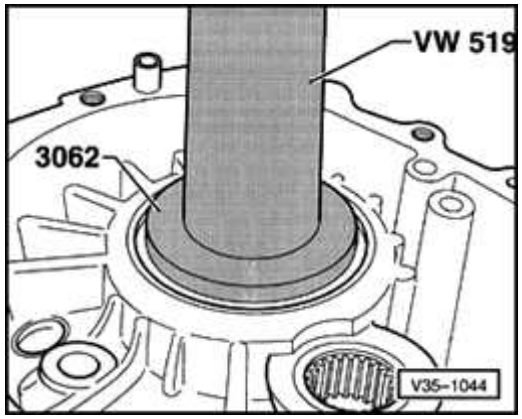


- Press inner race -1- for double tapered roller bearing onto pinion shaft and secure ⇒ Page 35-21 .
- Position needle bearing -2-.
- Install circlip 3 onto hollow shaft and press on inner race for tapered roller bearing -4- ⇒ Page 35-21 .
- Insert pinion shaft in hollow shaft.

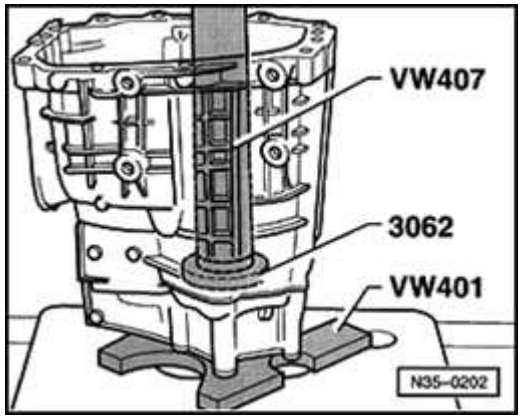
Note:

Illustration shows hollow shaft without gears. The adjustment of the pinion shaft can be done with or without gears.

39-42



- Install double tapered roller bearing outer race for pinion shaft in transmission housing without shims ⇒ Fig. 3, Page 35-31 .



- Install tapered roller bearing outer race for pinion shaft in transmission cover together with shim S4* (1.0 mm thick) ⇒ Fig. 8, Page 35-33 .

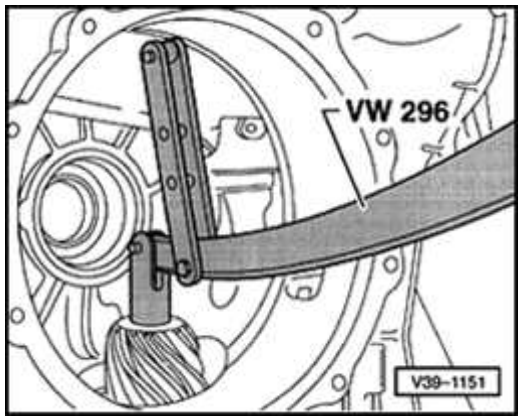
Notes:

- *A shim S4 with a thickness of 1.0 mm is installed for initial measurement. It is referred in the following text as S4*. After determining measurement "e", S4* is replaced with the appropriate shim S4.*
- *When taking measurements, always install the rubber washer together with the pressure plate for the rubber washer ⇒ Page 35-29 .*

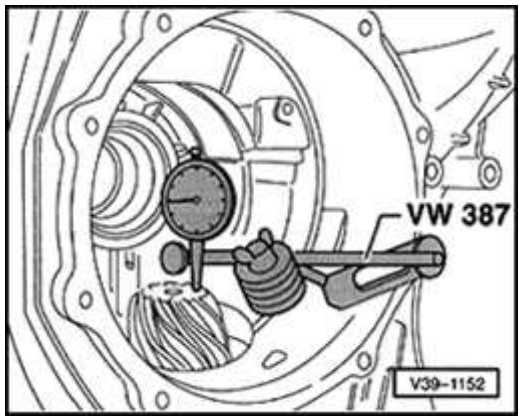
- Install fully assembled pinion shaft with hollow shaft into transmission housing.

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

- Turn transmission so transmission cover faces downward.



- Press down on face of pinion shaft using VW296 removal tool until tapered roller bearing outer race contacts transmission cover.
- While still maintaining pressure, rotate pinion shaft 5 turns in each direction opposite hollow shaft to settle double tapered roller bearing.
- Rotate pinion shaft together with hollow shaft 5 turns in each direction to settle tapered roller bearing.



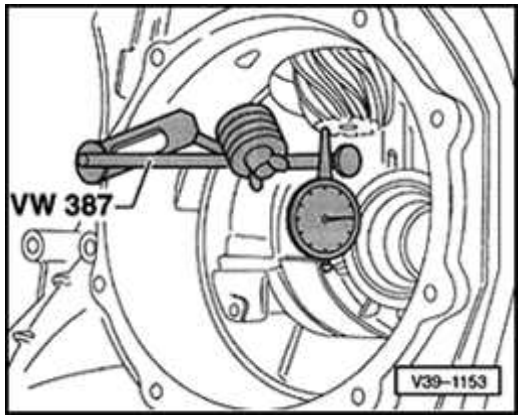
- Assemble measuring equipment, use 30 mm dial indicator extension.
- Set dial indicator (3 mm measuring range) to "0" with 1 mm preload.

Note:

The dial indicator extension must contact the machined surface on the face of the pinion shaft.

- Turn transmission 180° so transmission cover faces upward.

- Rotate pinion shaft together with hollow shaft 5 turns in each direction to settle tapered roller bearing. Otherwise measurement will not be correct.



- Read off and note play indicated on dial indicator.

  Measurement in example: 0.45 mm

Note:

If the measurement has to be repeated, first rotate the pinion shaft with hollow shaft again 5 turns in each direction to settle the tapered roller bearing. Then set the dial indicator to "0" again with 1 mm preload.

Formula:

Stotal = S4* + measurement + bearing preload

Example:

	Inserted shim S4*	1.00 mm
+	Measurement (example)	0.45 mm
+	Bearing preload (constant)	0.15 mm
=	Total shim thickness Stotal for S3 + S4	
		1.60 mm

Determining thickness of shim S3*

Formula:

S3* = Stotal - S4*

Example:

	Total shim thickness Stotal for S3 + S4	1.60 mm
-	Inserted shim S4*	1.00 mm
=	Thickness of shim S3*	0.60 mm

- Remove double tapered roller bearing outer race, install shim S3* in transmission housing and re-install outer race ⇒ Fig. 3, Page 35-31 .

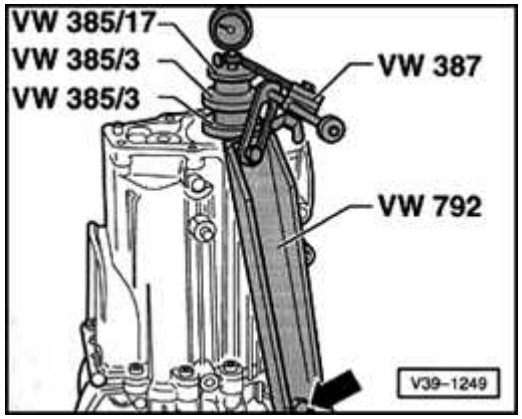
- Insert fully assembled pinion shaft into transmission housing again.

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

- Rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft

separately in relation to hollow shaft 5 turns in each direction, to settle tapered roller bearings.

39-46



- Install measuring tools and secure to transmission housing using bolt (arrow).
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft several times.
- If correct shims have been selected, dial indicator will now indicate the following value:

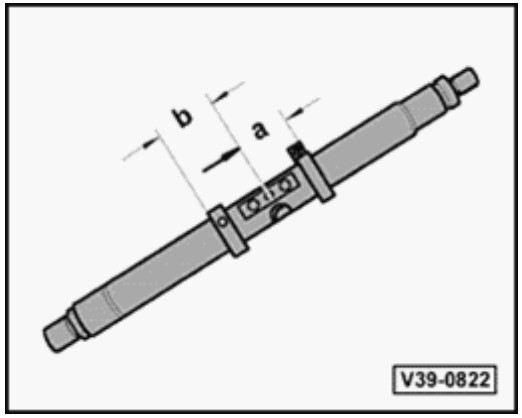
  0.05-0.15 mm
- Tighten transmission cover bolts again to 22 Nm (16 ft lb).
- Remove measuring tools.
- To settle tapered roller bearings, rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft separately in relation to hollow shaft 5 turns in each direction.

39-47

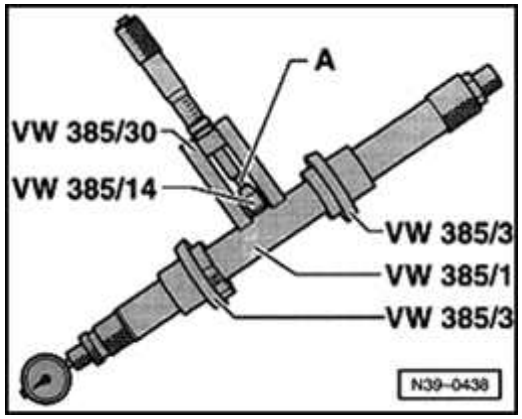
Determining measurement "e"

Note:

Measurement "e" is required to determine the final shim thickness of S3 and S4.

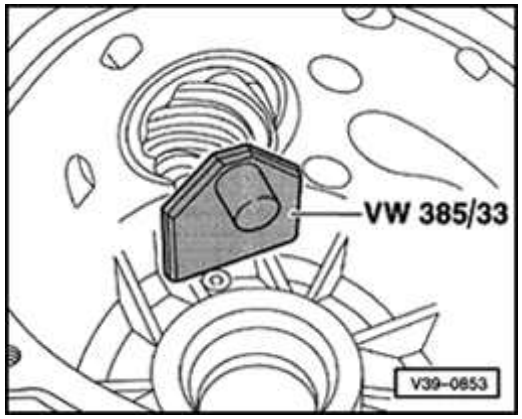


- Set adjustment rings of universal mandrel using VW385/1 measuring bar to the following measurements:
  - Dimension a: 35 mm (1.378 in.)
  - Dimension b: 75 mm (2.953 in.)



- Assemble VW385/1 measuring bar as illustrated:
  - Dial indicator extension -A-, 6.5 mm long
  - VW385/30 master gauge-adjustable
- Set VW385/30 master gauge to Ro = 54.95 mm (2.163 in.)for 170 mm (6.693 in.) diameter ring gear and install on universal mandrel.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.

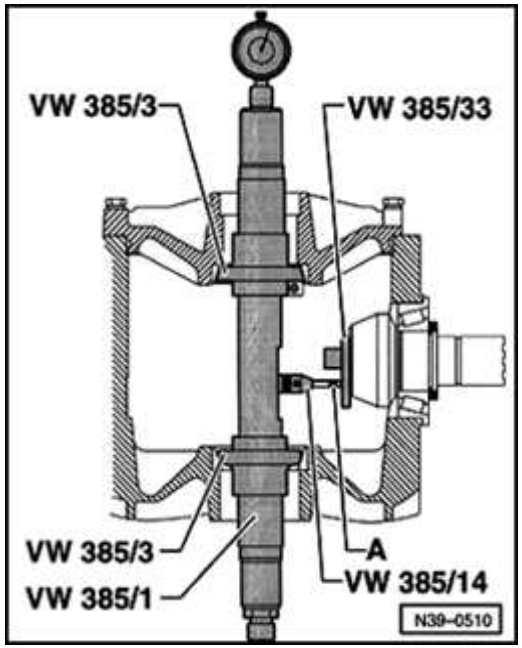
39-48



- Place end gauge on face of pinion shaft.

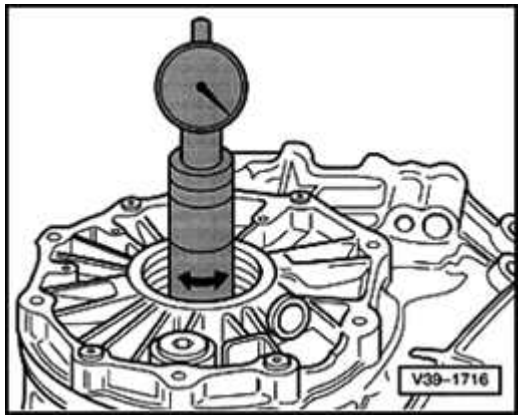
Note:

Make sure gauge contact surface is precisely installed and free of oil.



- Remove master gauge and install measuring mandrel into transmission housing.
  - Dial indicator extension -A- = 6.5 mm long must be installed.
  - The VW385/3 centering disc faces cover for final drive
- Install differential cover and tighten 4 bolts to 22 Nm (16 ft lb).
- Using adjustable ring, pull 2nd VW385/3 centering disc out as far as possible, so mandrel can only just be turned by hand.

39-49



- Turn mandrel until dial indicator plunger tip touches end gauge on pinion shaft head, measure maximum runout (return point).

Measurement in following example "e" = 0.26 mm (red scale)

Note:

After removing universal mandrel, and with VW385/30 master gauge in place, check dial indicator again to see if it indicates "0" with 2 mm preload, otherwise correct adjustments.

Determining thickness of shim "S3"

Formula:

S3 = S3* + r + e

(-e- in black scale)

or

S3 = S3* + r - e

(-e- in red scale)

Notes:

The deviation "r" (tolerance) related to the VW385/30 master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear.

- If measurements are based on red scale, subtract value "e."

- If measurements are based on black scale, add value "e."

Example:

	Shim S3* installed	0.60 mm
+	Deviation r	0.38 mm
-	Value measured for "e" (in red scale)	0.26 mm
=	Thickness of shim S3	0.72 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S3"

Shim thickness (mm)1)		
0.40	0.55	0.70
0.45	0.60	0.75

0.50	0.65	

1) Using shim tolerances it is possible to find the exact shim thickness required, insert two shims if necessary.

39-51

Determining thickness of shim "S4"

Formula:

S4 = Stotal - S3

Example:

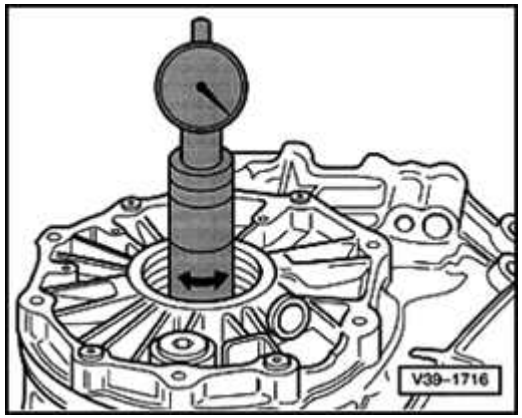
	Total shim thickness Stotal for S3 + S4	1.60 mm
-	Thickness of shim S3	0.72 mm
=	Thickness of shim S4	0.88 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

Available shims for "S4"

Shim thickness (mm)1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using shim tolerances it is possible to find the exact shim thickness required, insert two shims if necessary.



Checking measurement

Checking dimension "r"

- Install pinion shaft/hollow shaft with measured shims S3 and S4.

- Turn hollow shaft against pinion shaft 5 turns in both directions, so tapered roller bearing can settle.

- Insert universal mandrel ⇒ determining measurement "e", ⇒ Page 39-47 and perform check measurement.
- Read off dial indicator counterclockwise (red scale).

  If the shims have been correctly selected, deviation "r" (marked on outer circumference of ring gear) must be displayed - within a tolerance of ± 0.04 mm

Note:

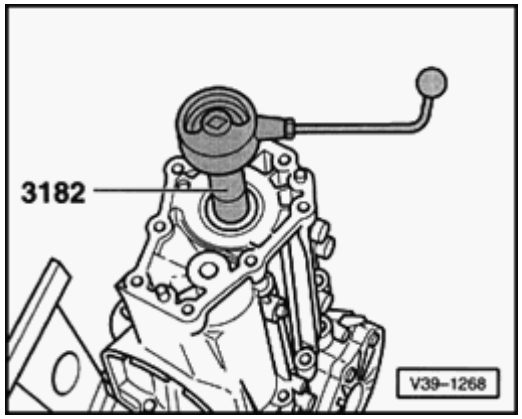
After removing universal mandrel, and with VW385/30 master gauge in place, check dial indicator again to see if it indicates "0" with 2 mm preload, otherwise correct adjustments.

Measuring friction torque

Notes:

- *Pinion shaft/hollow shaft tapered roller bearings are low friction bearings. Therefore the friction torque has only a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings to perform the friction torque measurement. These bearings have already been treated with a special oil by the manufacturer.*



- Install torque gauge, 0-600 Ncm (53 in. lb) on pinion shaft.
- Read off friction torque.

Friction torque specification:

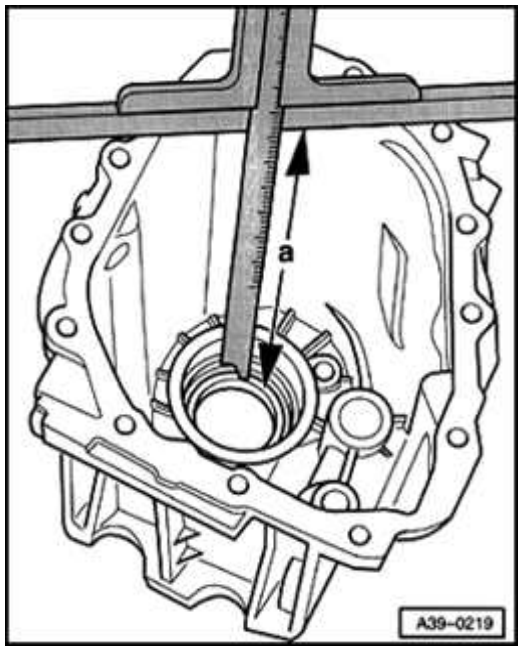
New bearings	Used bearings
150-250 Ncm (13-22 in. lb)	30-60 Ncm (3-5 in. lb)

Transmission cover, replacing (re-calculating shim S4

Special tools and equipment

- VW385/3 centering disc (2x)
- VW385/17 magnetic plate
- VW387 dial indicator holder
- VW792 installation arbor
- Dial indicator
- Dial indicator extension
- Depth gauge with minimum 5/100 mm precision

39-55



- Clean housing mating surfaces.

- Measure difference in depth -a- on old and new transmission covers.

Example:

	Depth "a" (old transmission cover)	257.40 mm
	Depth "a" (new transmission cover)	257.55 mm
=	Difference	0.15 mm

- Install thicker shim S4 if new transmission cover is deeper.
- Install thinner shim S4 if old transmission cover is deeper.

Example:

	Previous shim S4	0.95 mm
+	Difference	0.15 mm
=	New shim S4	1.10 mm

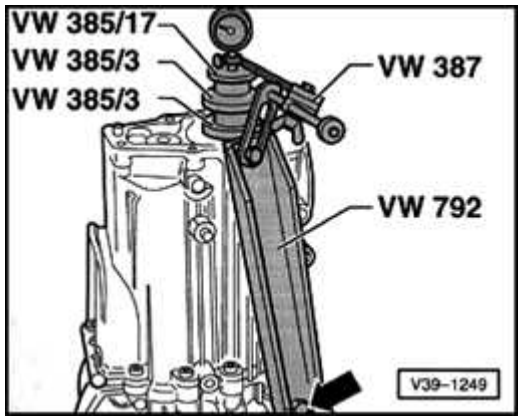
Available shims ⇒ table, ⇒ Page 39-51 .

- Press tapered roller bearing outer race with shim S4 into transmission cover ⇒ Fig. 8, Page 35-33 .

- Reinsert assembled pinion shaft into transmission housing fully.

- Install transmission cover and tighten bolts to 22 Nm (16 ft lb).

- To settle tapered roller bearings, rotate pinion shaft together with hollow shaft 5 turns in each direction, then rotate pinion shaft separately in relation to hollow shaft 5 turns in each direction.



- Install measuring tools and secure with bolt (arrow) to transmission housing.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.
- Loosen transmission cover bolts and turn pinion shaft several times.

If correct shims have been selected, dial indicator will now indicate following value:

0.05-0.15 mm

If this reading is not obtained the adjustment must be corrected.

Ring gear, adjusting

Adjusting differential

For a list of the repairs which will require the ring gear to be adjusted ⇒ table, ⇒ Page 39-37 .

Special tools and equipment

- VW382/10 extension pin
- VW385/17 magnetic plate
- VW386A clamping piece
- VW387 dial indicator holder
- VW388 measuring lever
- VW402 thrust plate
- VW408A punch
- VW472/1 pressure piece
- VW521 adjustment tool

- Torque gauge 0-600 Ncm (53 in. lb)
- Dial indicator
- Dial indicator extension

39-58

Determining total shim thickness "Stotal" (S1 + S2)

Adjusting preload of tapered roller bearings for differential

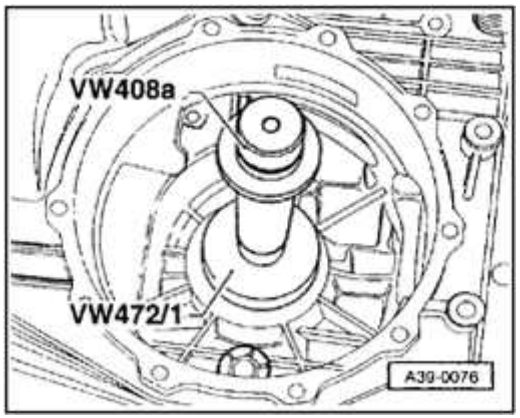
- Pinion shaft removed

Note:

If only the tapered roller bearings for the differential are being replaced, the ring gear can be removed from the differential housing. The pinion shaft does not have to be removed.

- Remove seals and outer races of both tapered roller bearings for differential.

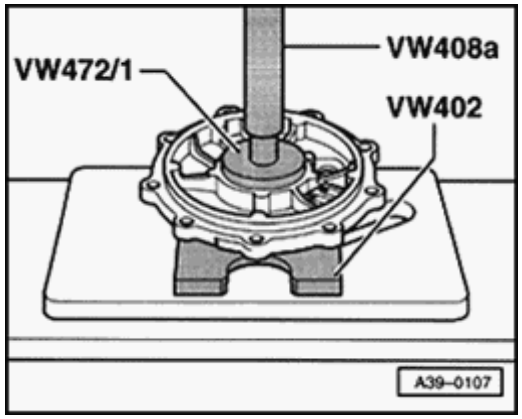
- Remove shims ⇒ Page 39-21 .



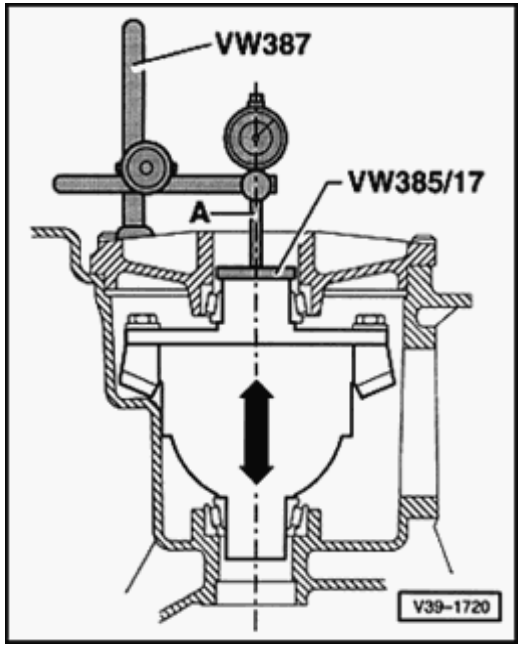
- Press right tapered roller bearing outer race with shim S2 into transmission housing ⇒ Fig. 2, Page 39-27 . Shim S2* with thickness of 1.20 mm (two 0.60 mm shims) is used for initial measurement.

Note:

For measurement purposes, a shim S2 of 1.20 mm is initially inserted and referred to as S2 in the following text. After determining backlash, S2* will be replaced by the correct shim S2.*



- Press tapered roller bearing outer race into differential cover without shim S1 ⇒ Fig. 8, Page 39-31 .
- Insert differential without speedometer gear drive into transmission housing. Ring gear is positioned on left-hand side infront of final drive cover.
- Install differential cover with 4 bolts and tighten to 25 Nm (18 ft lb).
- Position transmission so differential cover faces upward.
- Turn differential 5 turns in both directions so tapered roller bearings settle.



- Assemble measuring equipment, using 30 mm dial indicator extension.
- Set dial indicator (3 mm measuring range) -A- to "0" with 2 mm preload.

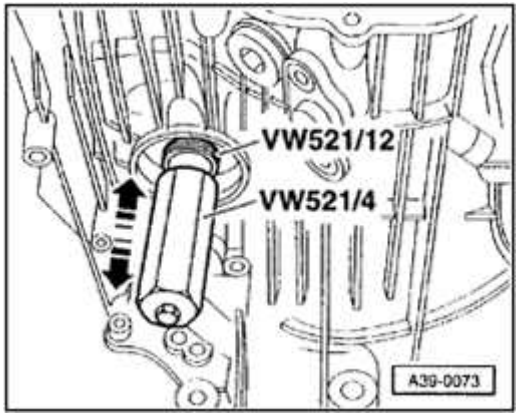
Note:

The tip of the dial indicator must be positioned on the center of the differential.

- Lift differential without turning, and read off play on dial indicator.

- Measurement in following example: 0.62 mm

Notes:



- *To lift the differential, attach VW521/4 locking sleeve and VW521/12 on the right of the differential (housing side).*
- *If the measurement has to be repeated, the pinion shaft with hollow shaft must be turned 5 turns in each direction first to settle the tapered roller bearing.*

Formula:

Stotal = S2*- + measurement + bearing preload

Example

	Inserted shim(s) S2*	1.20 mm
+	Measured value	0.62 mm
+	Bearing preload (constant value)	0.30 mm
=	Total thickness Stotal for S1 + S2	2.12 mm

Determining thickness of shim "S1*"

Notes:

- *The preliminary adjustment shim S1* will be replaced with the final shim S1 after determining the backlash.*
- *The total shim thickness Stotal remains unchanged.*

Formula:

S1* = Stotal - S2*

Example:

	Total thickness Stotal for S1 + S2	2.12 mm
-	Inserted shim(s) S2*	1.20 mm
=	Thickness of shim S1*	0.92 mm

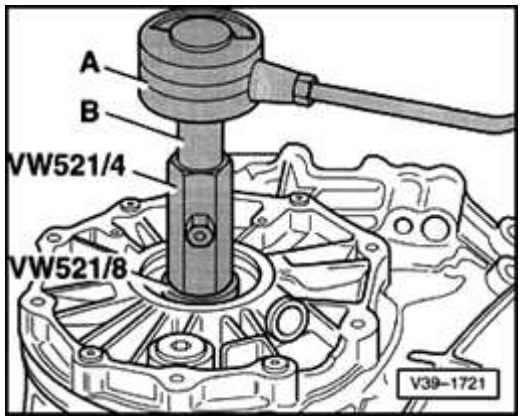
Measuring friction torque

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- Pinion shaft removed



- Install torque gauge 0-600 Ncm (53 in. lb) -A- onto differential.

B - Socket

- Read friction torque.

Friction torque specifications:

New bearings	Used bearings
150-350 Ncm (13-31 in. lb)	30-60 Ncm (3-5 in. lb)

Note:

For a readjustment of the final drive gear set (pinion shaft and ring gear), the pinion shaft adjustment should now be checked ⇒ Page 39-39 .

39-63

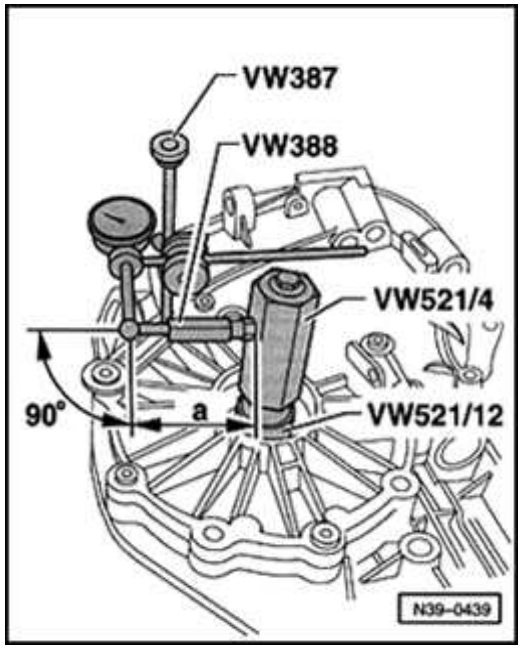
Measuring backlash

Position of ring gear in transmission housing

- Pinion shaft with shims S3* and S4* installed

- Install differential.

- Turn differential 5 turns in each direction to settle tapered roller bearings.



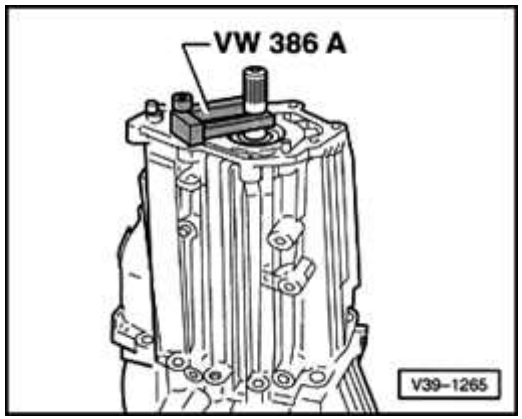
- Secure VW387 dial indicator holder onto housing.
- Attach VW521/4 locking sleeve and VW521/12.
- Install dial indicator and VW382/10 extension pin (6 mm flat).
- Adjust VW388 measuring lever to dimension -a-:

  Distance -a-: 67 mm (2.637 in.) for 170 mm (6.693 in.) diameter ring gear.
- Determine play between teeth flanks as follows:
  - Turn ring gear until it makes contact with tooth flank (end of backlash travel).
  - Set dial indicator to "0" with 2 mm preload.
  - Turn ring gear back against opposite tooth flank (backlash).

- Recording (backlash) indicated on gauge.

- Turn ring gear 90° further each time and repeat measurement 3 times.

Notes:



- *Install VW386A clamping piece if the pinion shaft rotates when the differential is turned. This way the exact backlash can be measured.*
- *Loosen clamping piece in order to turn the ring gear further.*

Determining average backlash

- Add four measured values together and divide by four.

Example:

	1st measurement	0.28 mm
+	2nd measurement	0.30 mm
+	3rd measurement	0.30 mm
+	4th measurement	0.28 mm
=	Sum of measured values	1.16 mm

- Result: the average backlash is 1.16 mm ÷ 4 = 0.29 mm

CAUTION!

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive gear set

itself is not correct. Check installation, replace final drive gear set if necessary.

Determining thickness of shim S2

Formula:

S2 = S2* - backlash + lift

Example:

	Inserted shim S2*	1.20 mm
-	Average backlash	0.29 mm
+	Lift (constant value)	0.15 mm
=	Thickness of shim S2	1.06 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for S2

Shim thickness (mm)1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) By using shim tolerances it is possible to find exact shim thickness required, insert two shims if necessary.

Determining thickness of shim "S1"

Formula:

S1 = Stotal - S2

Example:

	Total shim thickness Stotal for S1 + S2	2.12 mm
-	Thickness of shim S2	1.06 mm
=	Thickness of shim S1	1.06 mm

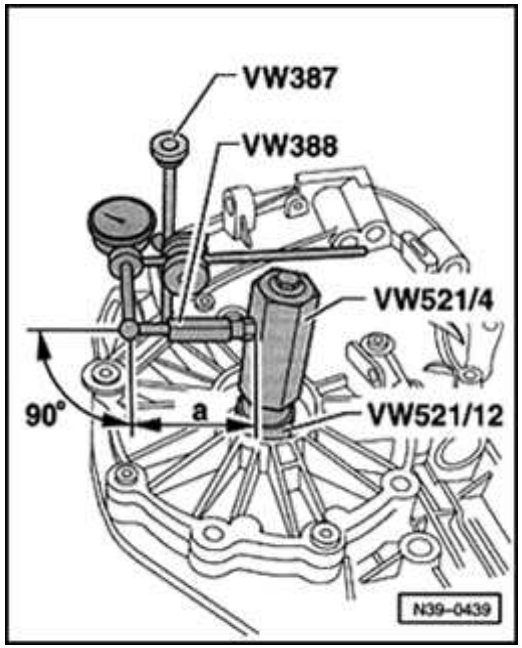
- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for S1

Shim thickness (mm)1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) By using shim tolerances it is possible to find the exact shim thickness required, insert two

shims if necessary.



Checking measurement

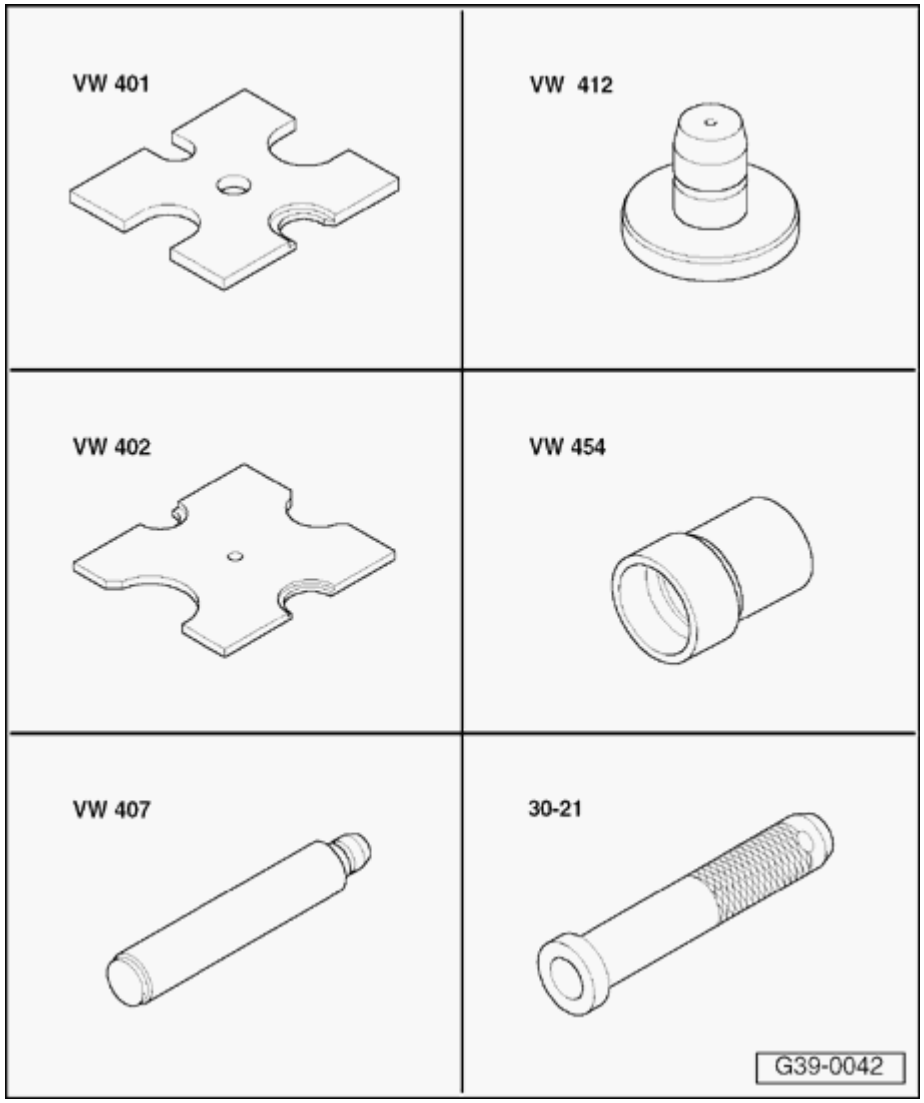
- After installing shims S1 and S2, turn differential 5 turns in both directions so that tapered roller bearings settle.
- Measure backlash four times on circumference.

  Specifications: 0.12-0.22 mm

Notes:

- *If the backlash lies outside the tolerances, the adjustments must be repeated. The total shim thickness Stotal must remain the same.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

39-45



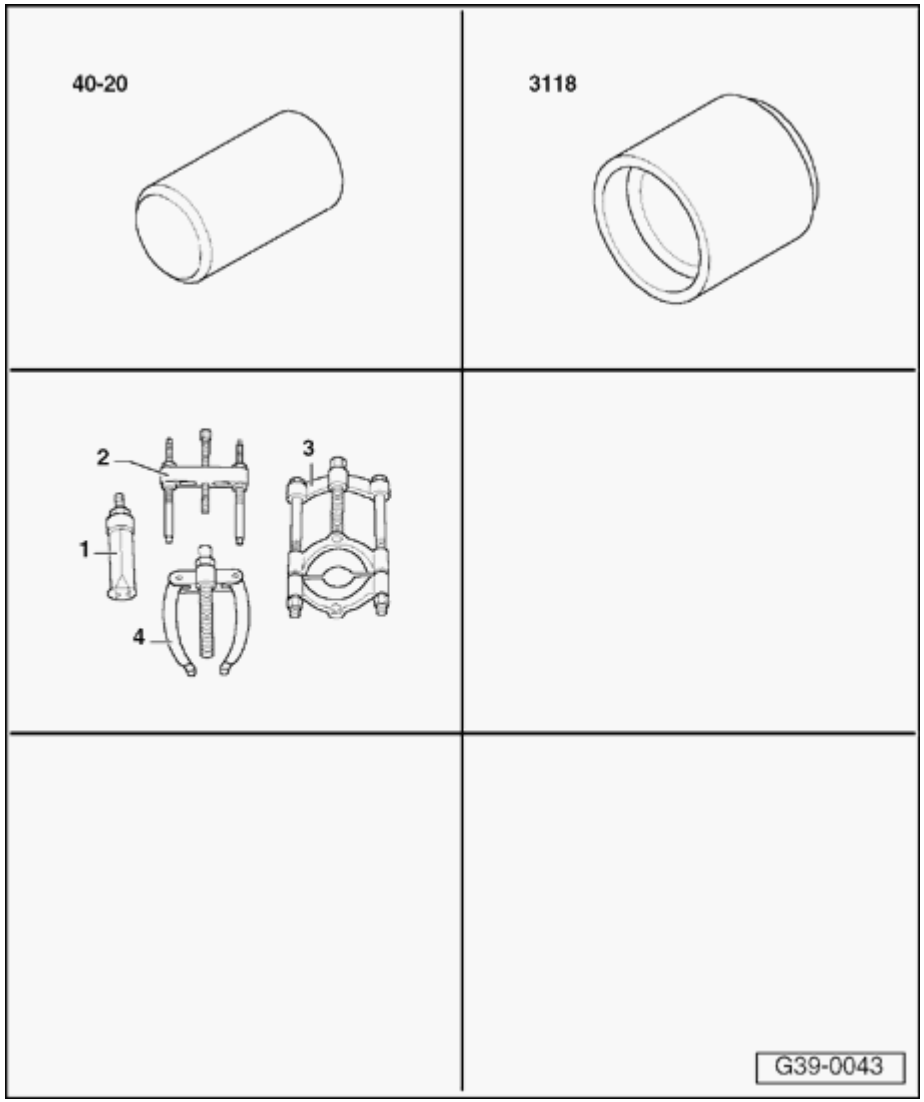
Center differential, servicing

Transmission installed

Special tools and equipment

- VW401 thrust plate
- VW412 punch
- VW402 thrust plate
- VW454 thrust tube
- VW407 punch
- 3021 protractor

39-46



- 4020 press tube
- 3118 press support
- Item 3 Kukko 17/2 separating tool

WARNING!

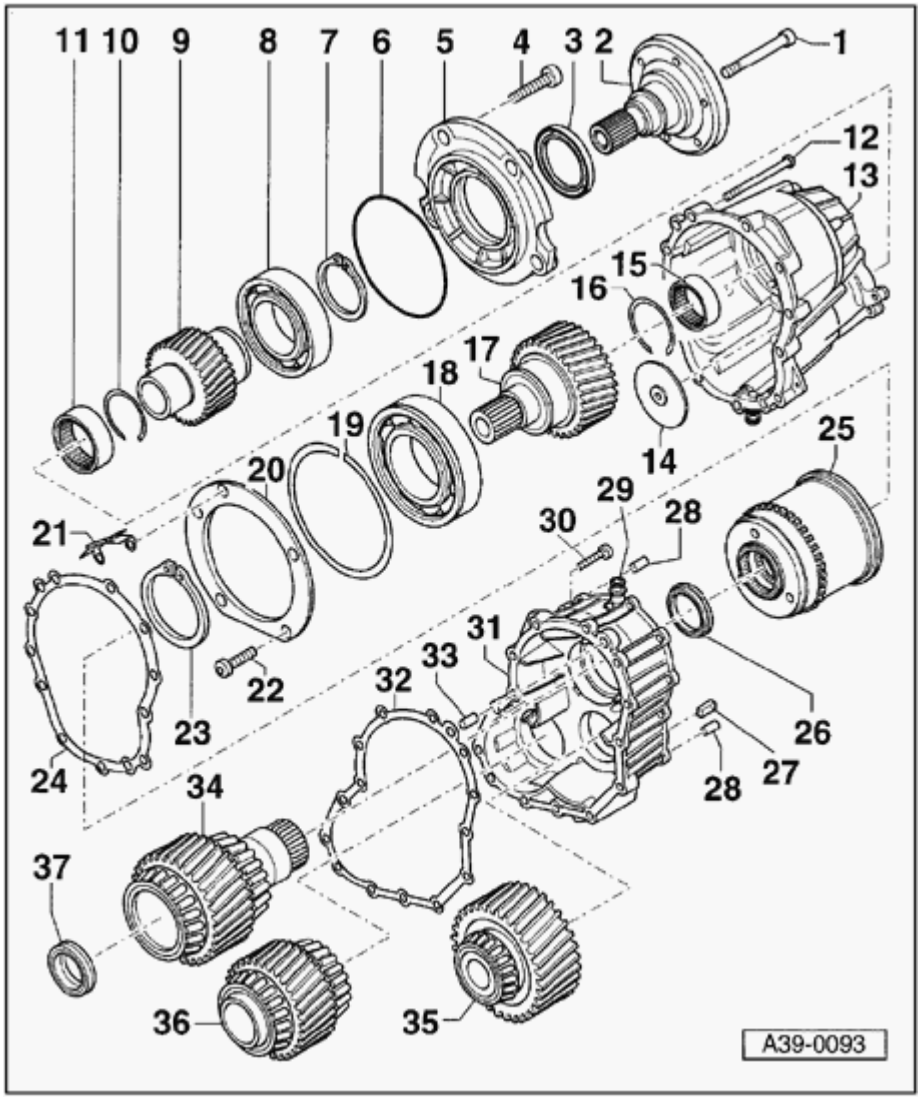
Do not run engine with the center differential removed or without gear oil and do not tow vehicle.

Notes:

- *Rules of cleanliness for working on automatic transmissions* ⇒ *page 37-148* .
- *General repair notes* ⇒ *page 00-27* .

The parts listed in the following illustration can be removed with the transmission installed.

39-47



1 - Socket head bolt - 25 Nm

2 - Rear drive flange

3 - Seal

- Always replace ⇒ page 39-61

4 - Bolt - 23 Nm

- 4x

5 - Housing cover

6 - O-ring

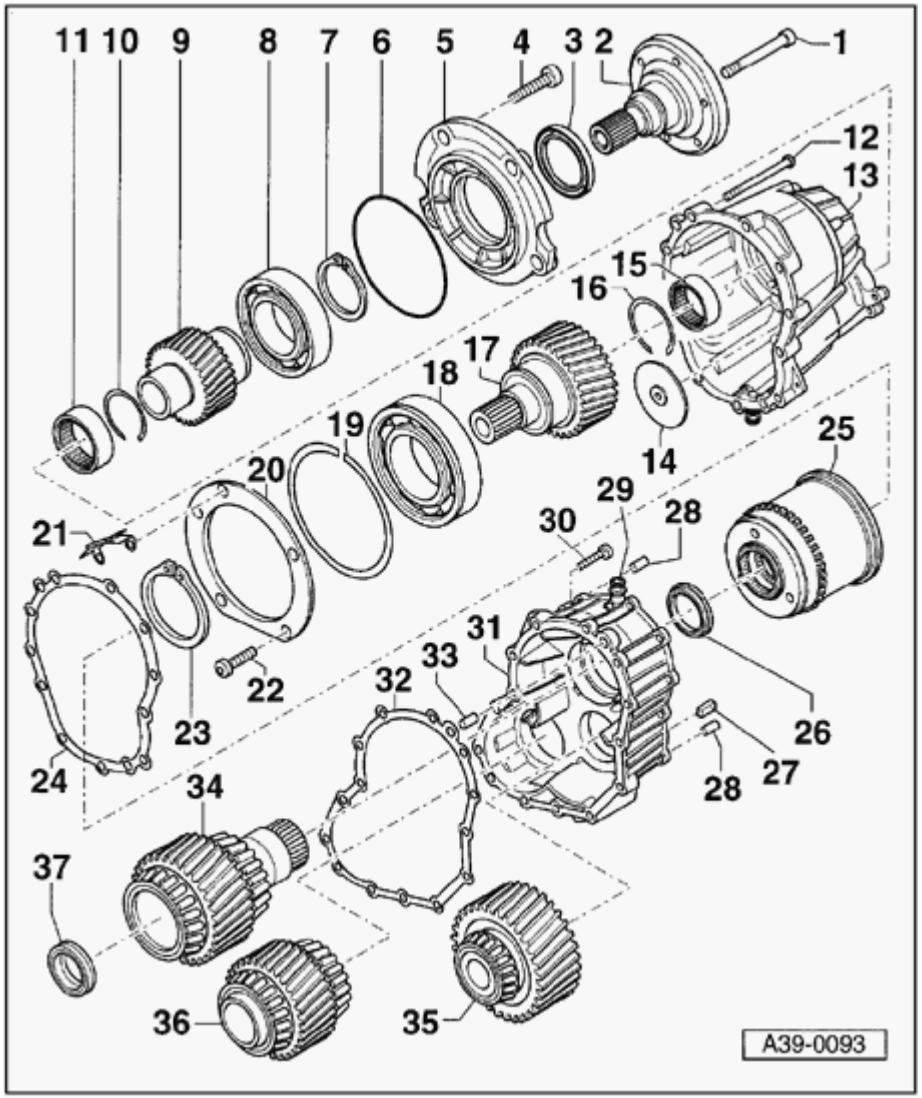
- Coat with transmission fluid

7 - Snap ring

8 - Grooved ball bearing

- For spur gear 1
- Pressing off ⇒ Fig. 1 , ⇒ page 39-54
- Pressing on ⇒ Fig. 2 , ⇒ page 39-54

39-48



9 - Spur gear 1

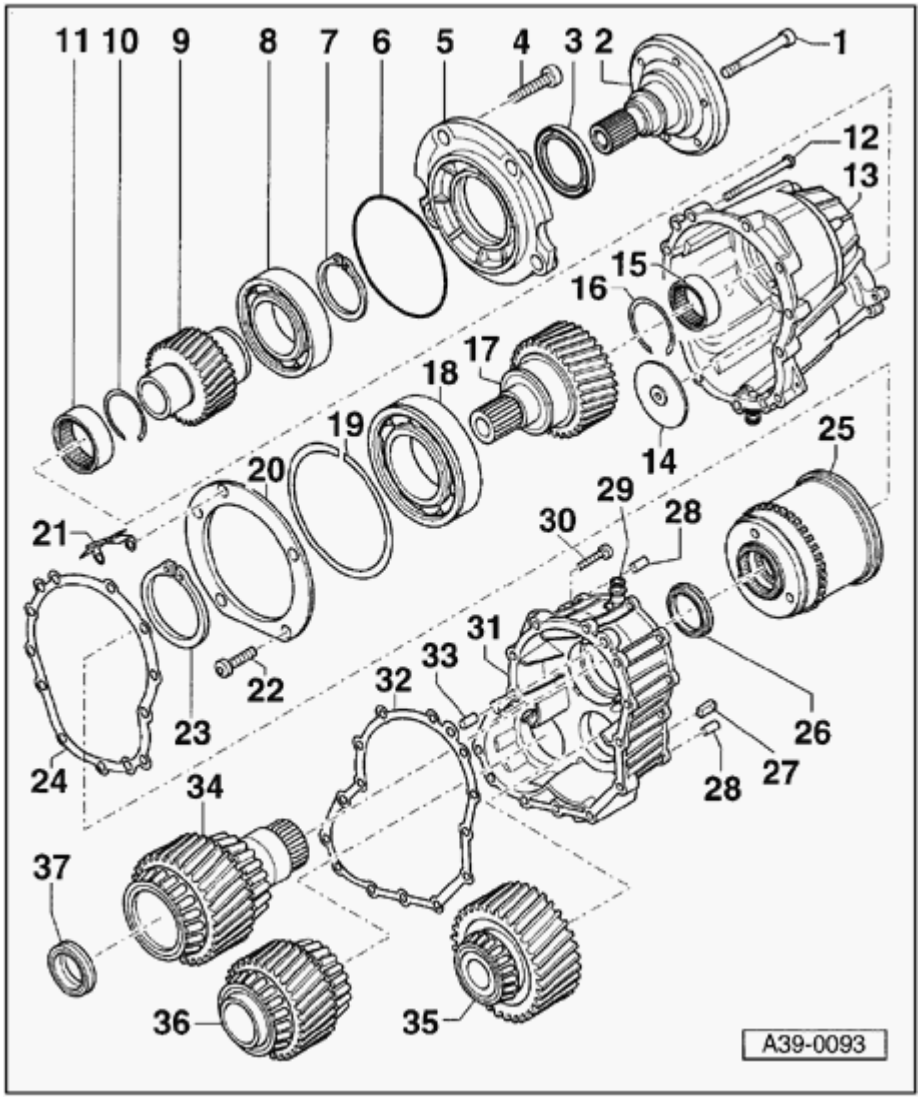
- For rear gear set
- If damaged, only replace together with spur gear 2 -Item 17 - Always replace
- To remove and install, pull out of center differential housing toward rear together with -item 7 - and -item 8 -

10 - Snap ring

11 - Needle bearing

- For spur gear 1
- Only remove for replacement
- To insert, heat up transfer gear housing to approx. 100 ° C and drive out needle bearing toward rear using drift (Warning! Wear protective gloves)
- Drive in to stop using 3021 protractor

39-49



12 - Bolt - 23 Nm

- Loosen or tighten in stages and in diagonal sequence

13 - Center differential housing

14 - Tension nut

- For rear drive flange -Item no. 2 -

15 - Needle bearing

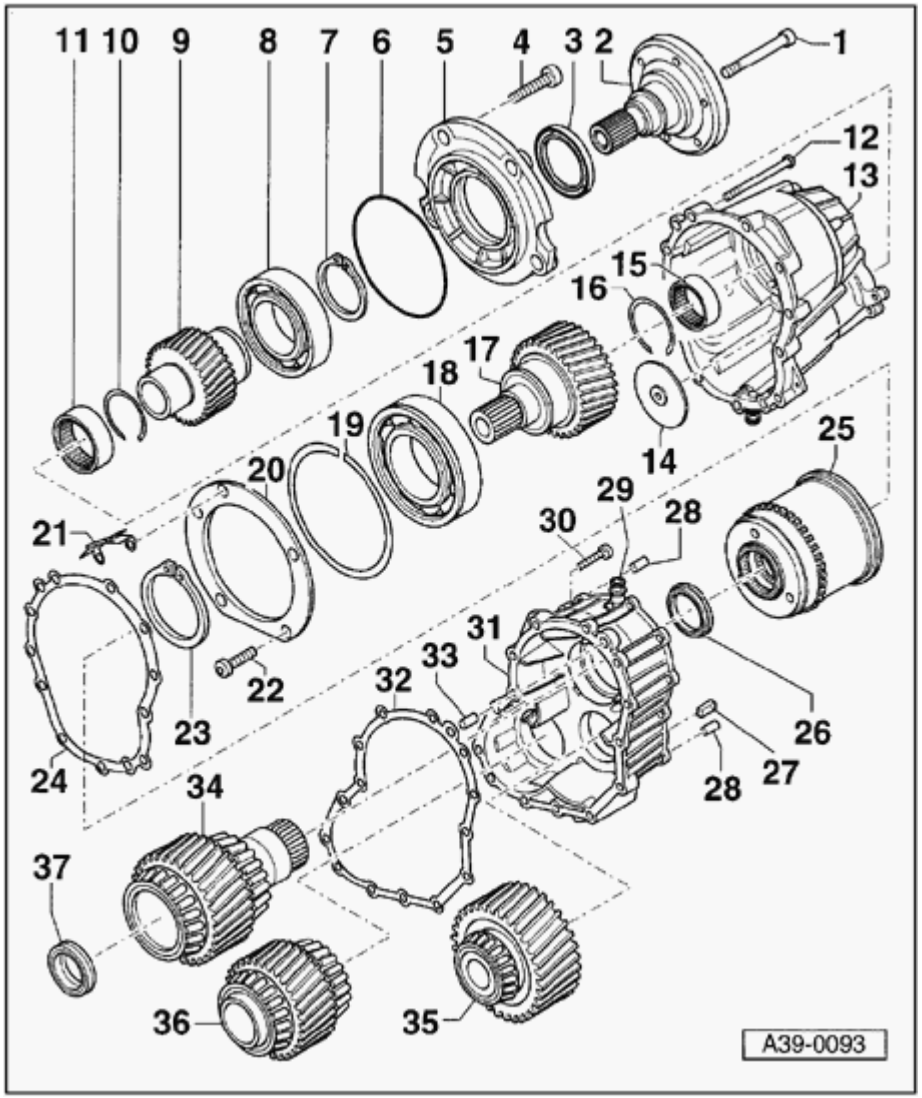
- For spur gear 2
- Only remove for replacement
- Always replace ⇒ page 39-69

16 - Snap ring

17 - Spur gear 2

- For rear gear set
- If damaged, only replace together with spur gear 1 -item 9 -
- To remove and install, remove center differential housing ⇒ page 39-56 and pull out together with -item 18 , 19 , 23 -

39-50



18 - Grooved ball bearing

- For spur gear 2
- Pressing off ⇒ Fig. 3 , ⇒ page 39-55
- Pressing on ⇒ Fig. 4 , ⇒ page 39-55

19 - Snap ring

- For securing grooved ball bearing -item 18 - in center differential housing

20 - Washer

- For grooved ball bearing -item 18 -
- Before installing, clip on guide plate -item 21 -

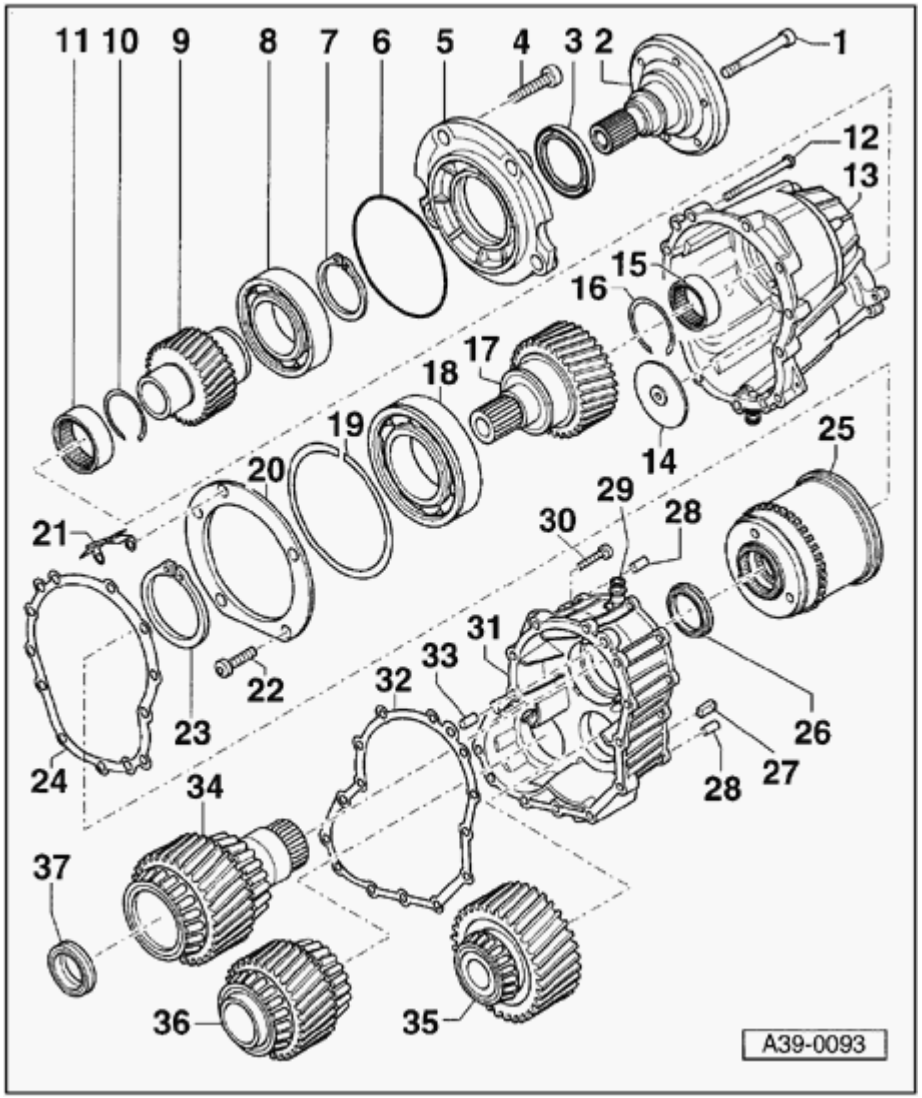
21 - Alignment plate

22 - Bolt 10 Nm

23 - Snap ring

- For securing grooved ball bearing -item 18 - on spur gear 2 - item 17 -

39-51



24 - Gasket

- Always replace ⇒ page 39-56

25 - Torsen differential

- If damaged replace as complete unit
- Removing and installing ⇒ page 39-56

26 - Seal

- Always replace ⇒ page 39-65

27 - Magnet

- Removing and installing ⇒ page 39-56

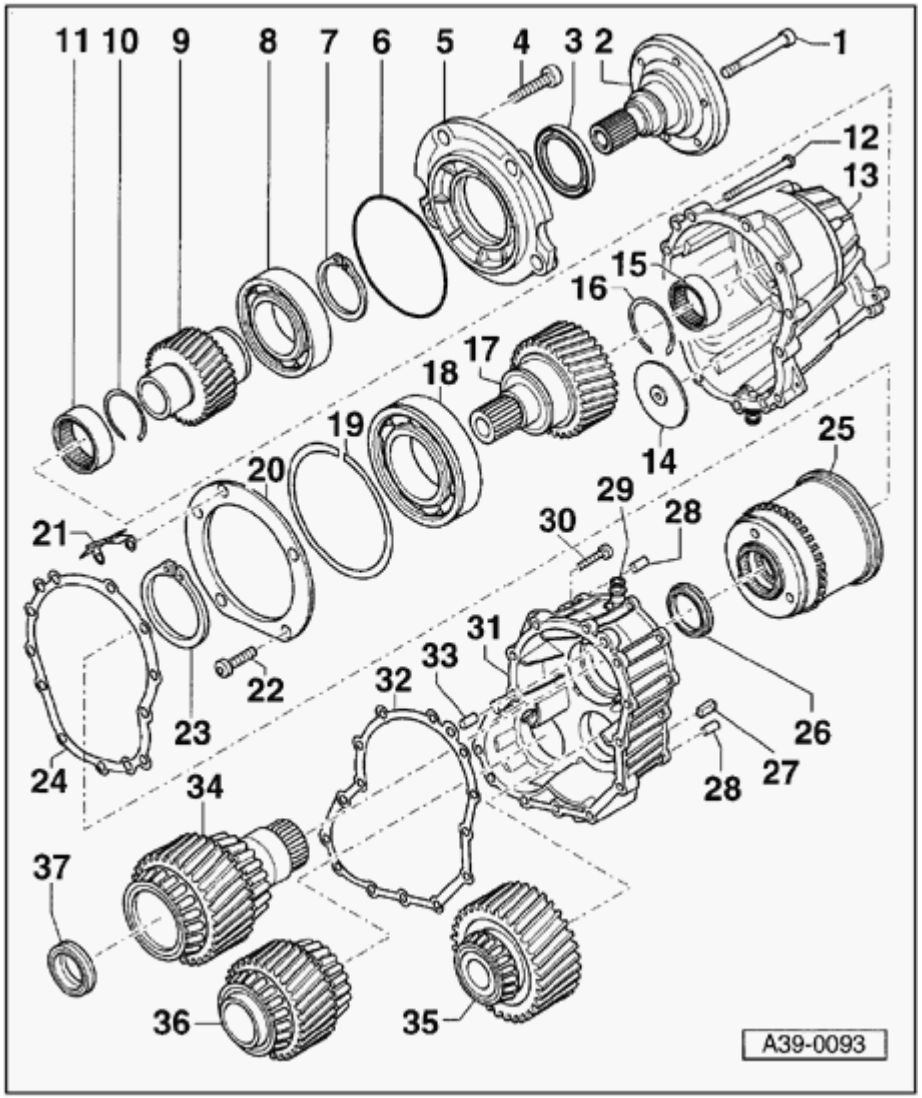
28 - Bushing

- 2x

29 - Breather

- For transfer gear
- With cap installed
- Installation position: Without cover, breather must project 10 to 11 mm out of housing

39-52



30 - Bolt - 23 Nm

- Observe tightening sequence ⇒ page 39-27

31 - Intermediate flange for front final drive

32 - Gasket

- Always replace ⇒ page 39-24

33 - Bushing

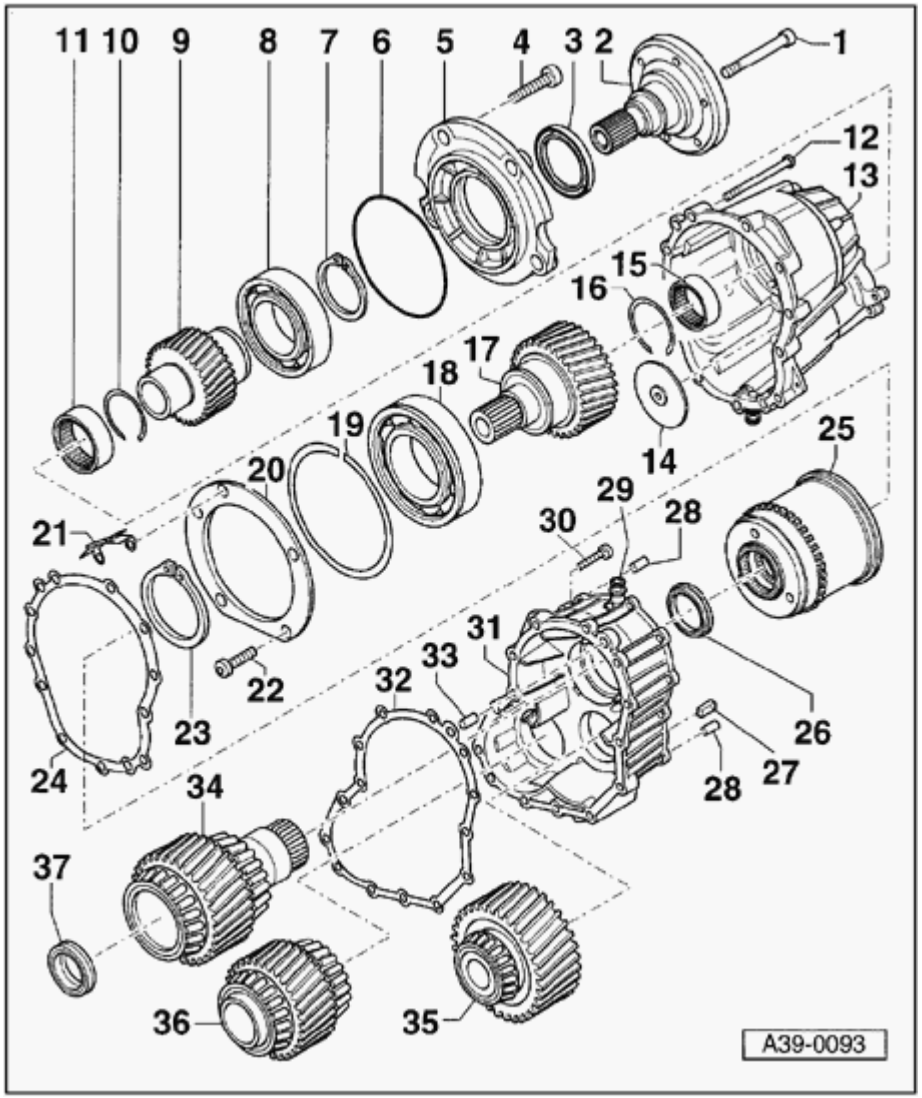
34 - Drive pinion

- For front final drive
- Removing and installing ⇒ page 39-67

35 - Intermediate pinion

- For front final drive
- Installation position: gear identification faces toward transfer gear

39-53



36 - Output pinion

- For front final drive
- Installation position: gear identification faces toward transfer gear

37 - Seal

- Always replace ⇒ page 39-67

39-54

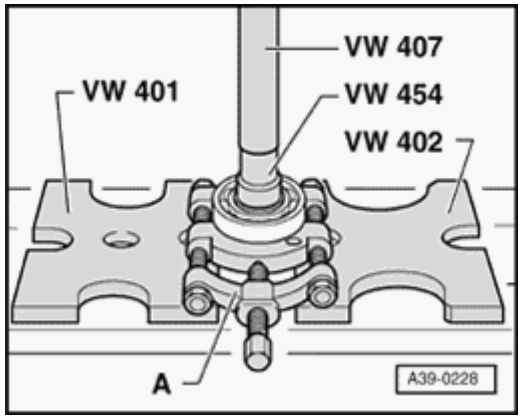


Fig. 1 Press off grooved ball bearing for spur gear 1

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

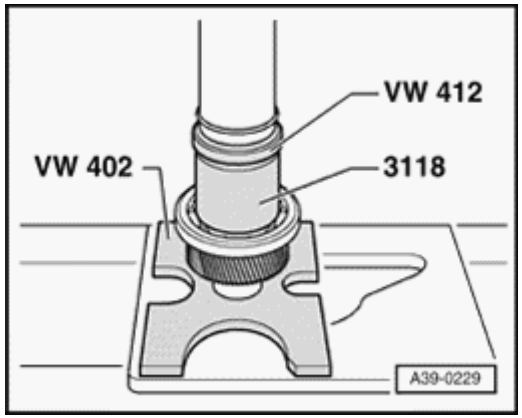


Fig. 2 Press on grooved ball bearing for spur gear 1

39-55

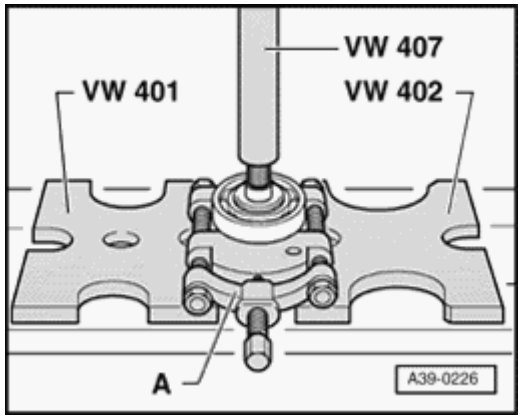


Fig. 3 Press off grooved ball bearing for spur gear 2

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

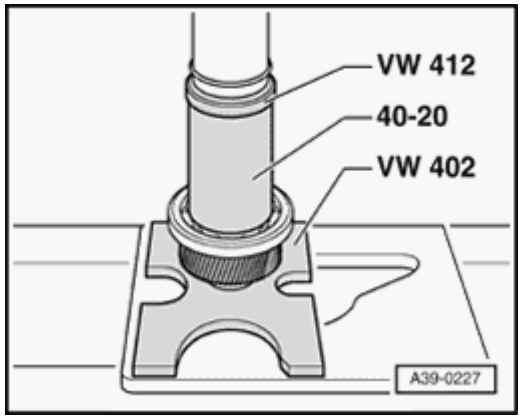


Fig. 4 Press on grooved ball bearing for spur gear 2

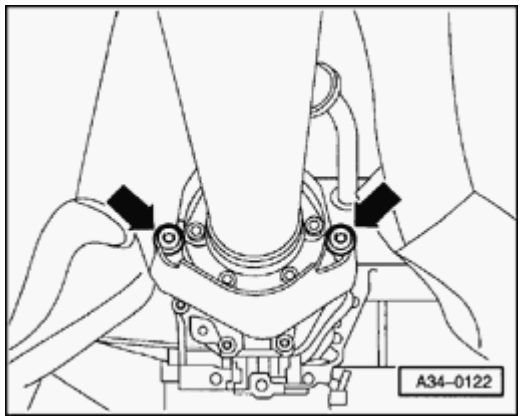
39-56

Center differential, removing and installing

Removing

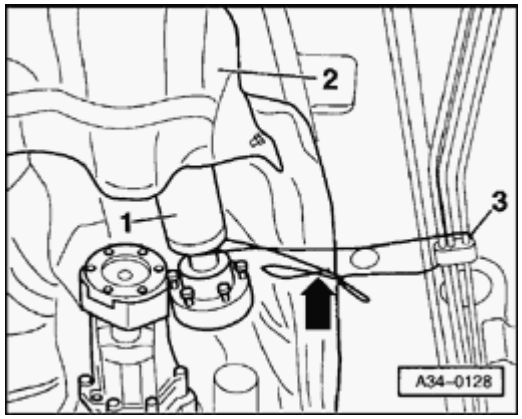
- Remove front exhaust pipes:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

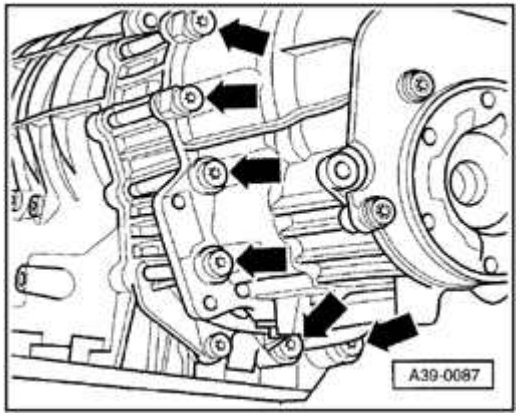


- Unbolt heat shield for driveshaft from cover for Torsen differential (arrows).

39-57



- Unbolt driveshaft -1- from transmission and let rest on heat shield -2- ⇒ page 39-79 , Driveshaft, removing and installing.
- Secure driveshaft using wire (arrow) at bracket -3- of fuel lines.
- Drain center differential gear oil ⇒ page 39-40 .

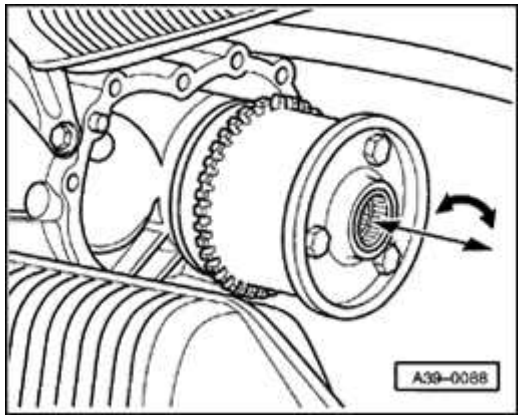


- Loosen mounting bolts (arrows) for center differential housing in diagonal sequence and remove.

WARNING!

Carefully pull center differential housing off of transmission toward rear. The Torsen differential could otherwise fall out of the transmission.

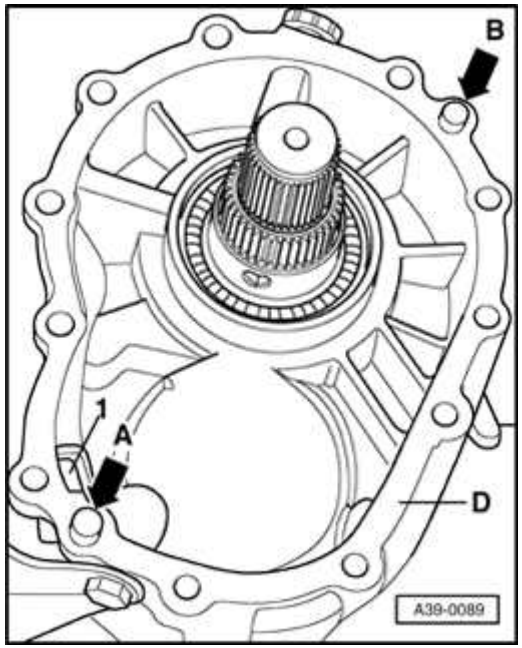
39-58



- Pull Torsen differential off output shaft toward rear.

Installing

Installation is reverse of removal, noting the following:



- Check for alignment bushing (arrow A) and (arrow B).
- Install gasket

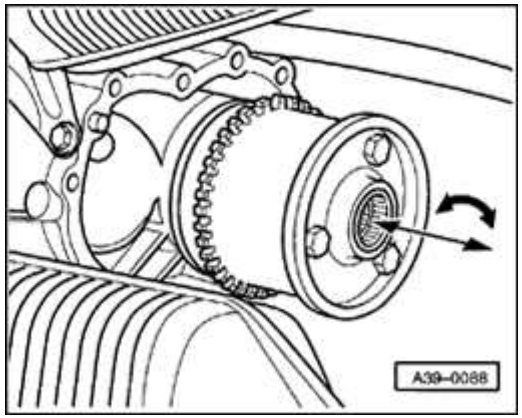
Note:

Lightly coat sealing surface -D- with gear oil to prevent the seal from slipping.

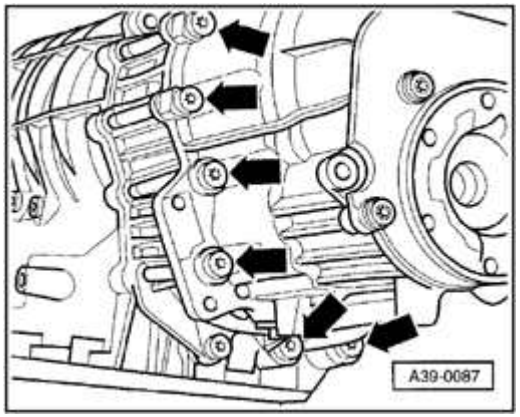
- Slide cleaned magnet into cast holding pocket -1- in intermediate flange.

39-59

- Add 200 ml. gear oil to output housing ⇒ (comparable to gear oil, topping up on removed and disassembled center differential ⇒ page 39-43).



- Install Torsen differential onto splines of output shaft and bottom spur gear while turning slowly.
- Check whether installed Torsen differential can be turned by hand.



- Install fully assembled transfer housing with installed spur gears and rear drive flange onto transmission flange.
- Insert bolts for transfer housing and tighten to final tightening torque in diagonal sequence in several stages.
- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.
- Fill transfer housing with gear oil and check oil level ⇒ page 39-40 .

39-60

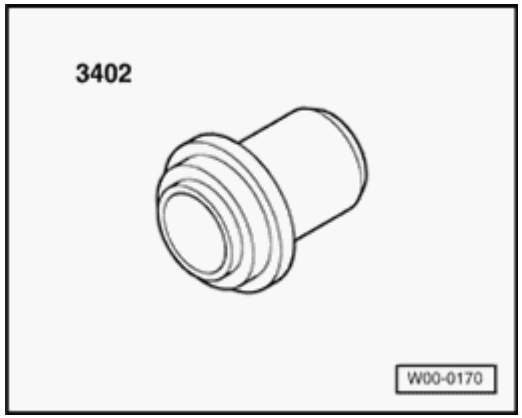
Tightening torques

Component	Nm
Center differential housing to transmission housing	23
Heat shield for driveshaft to transmission	23

39-61

O-ring for driveshaft output flange, replacing

Special tools and equipment

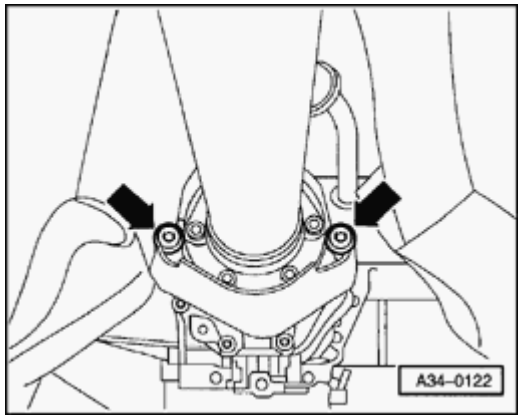


- 3402 pressure piece

Removing

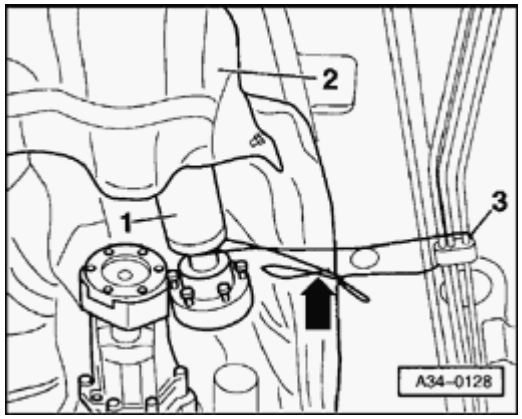
- Remove front exhaust pipes:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

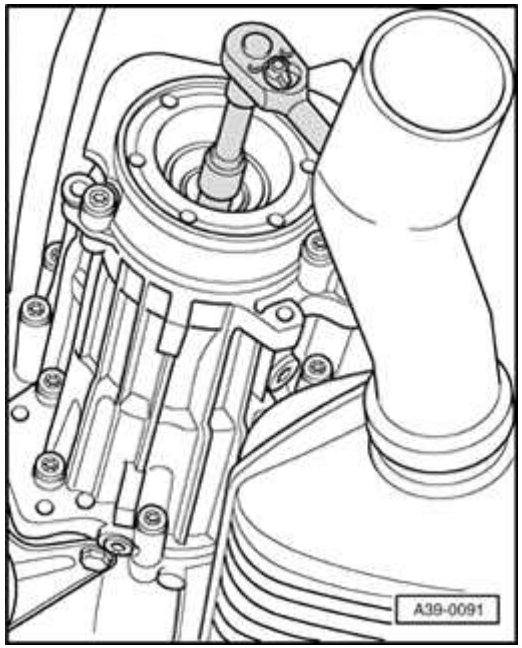


- Unbolt heat shield for driveshaft from cover for Torsen differential (arrows).

39-62

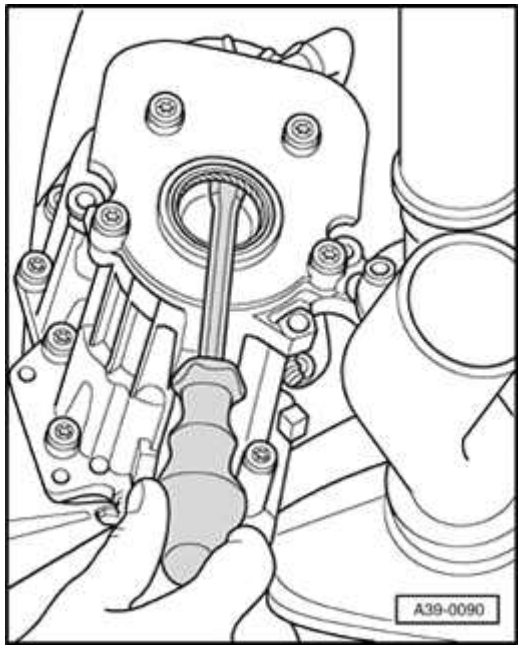


- Unbolt driveshaft -1- from transmission and let rest on heat shield -2- ⇒ page 39-79 , Driveshaft, removing and installing.
- Secure driveshaft using wire (arrow) at bracket -3- of fuel lines.
- Drain center differential gear oil ⇒ page 39-40 .

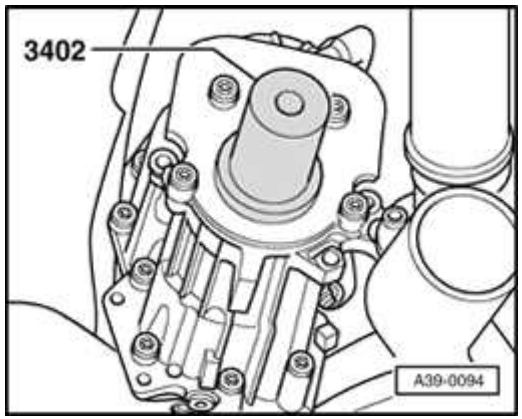


- Unbolt output flange while securing output flange against turning using a drift.
- Pull out output flange.

39-63



- Remove O-ring using appropriate screwdriver.



Installing

Installation is reverse of removal, noting the following:

- Drive O-ring in to stop using 3402 pressure piece.
- Secure output flange with socket-head bolt.
- Bolt driveshaft to transmission flange ⇒ page 39-79 , Driveshaft, removing and installing.
- Fill transfer housing with gear oil and check oil level ⇒ page 39-40 .

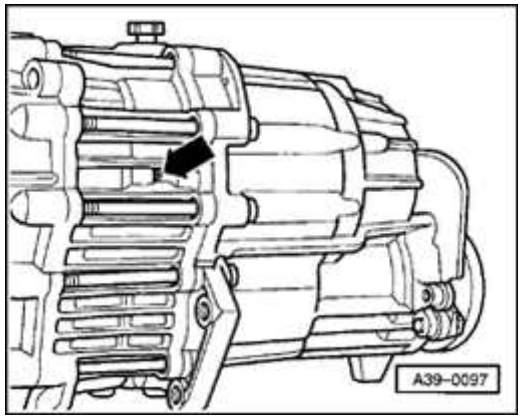
Tightening torques

Component	Nm
Socket-head bolt for rear drive flange	25
Heat shield for driveshaft to transmission	23

39-65

Seal in intermediate flange for front final drive, replacing

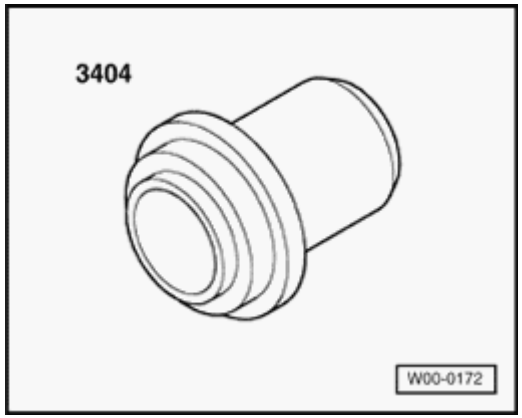
Note:



An inspection opening is provided on the left side of the intermediate flange to check for oil leaks (arrow) for the seal in drive pinion and the seal in intermediate flange.

If oil escapes at this inspection opening, this double seal must be replaced.

Special tools and equipment



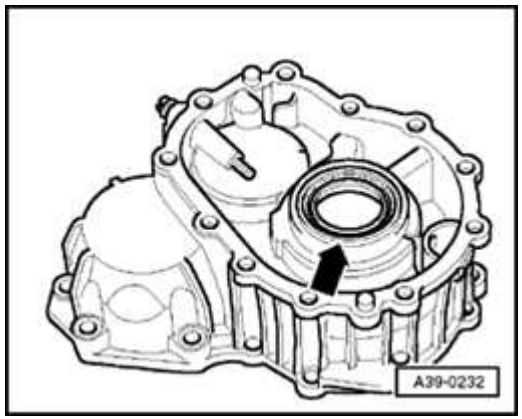
- 3404 thrust piece

39-66

Removing

- Remove center differential ⇒ page 39-56 .

- Remove intermediate flange for front final drive.

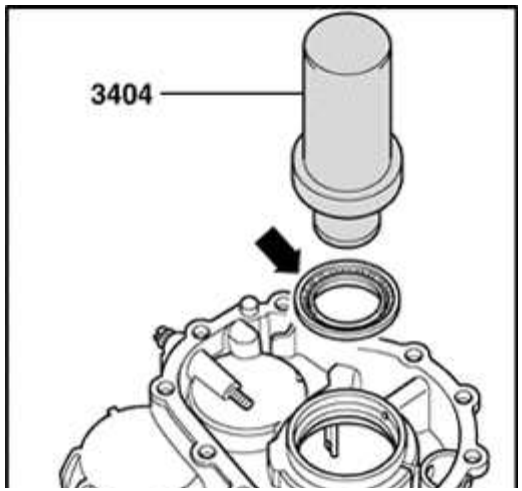


- Drive seal (arrow) out in direction of transfer gear using mandrel.

Installing

Installation is reverse of removal, noting the following:

- Check seal seat in transmission housing for damage; rework if necessary.



- Slide seal onto 3404 thrust piece so that the larger and projecting outer ring (arrow) of seal faces tool.
- Drive in seal up to 3404 thrust piece stop.

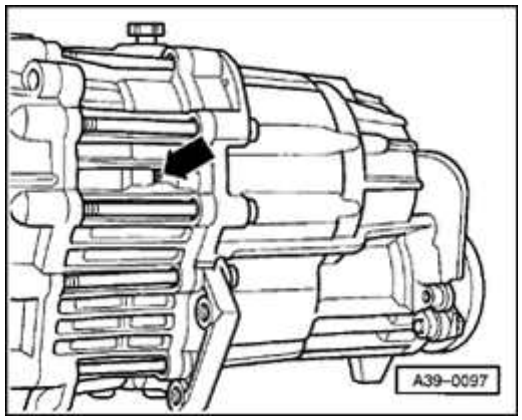
Note:

If installing the intermediate flange to the output shaft carelessly, the sealing lip of the seal can be damaged.

- Install center differential ⇒ page 39-58 .

Seal in drive pinion, replacing

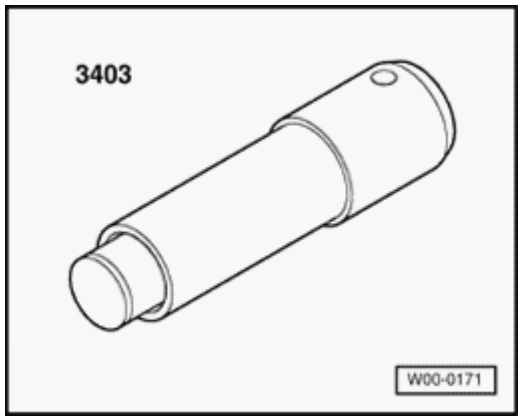
Note:



An inspection opening is provided on the left side of the intermediate flange to check for oil leaks (arrow) for the seal in drive pinion and the seal in intermediate flange.

If oil escapes at this inspection opening, this seal must be replaced.

Special tools and equipment



- 3403 thrust piece

Removing

- Remove center differential ⇒ page 39-56 .
- Remove intermediate flange for front final drive.
- Carefully pull off drive pinion from driveshaft.

39-68

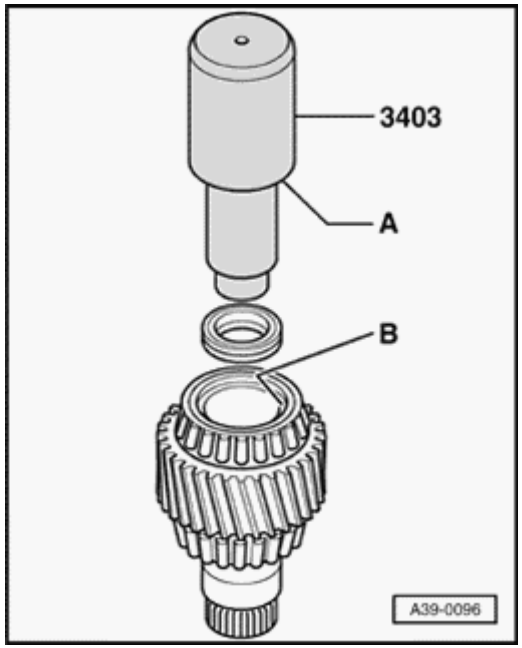
WARNING!

Do not reinstall spur gears that have fallen to the ground. The transmission must be replaced in this case.

- Drive out seal using drift.

Installing

Installation is reverse of removal, noting the following:



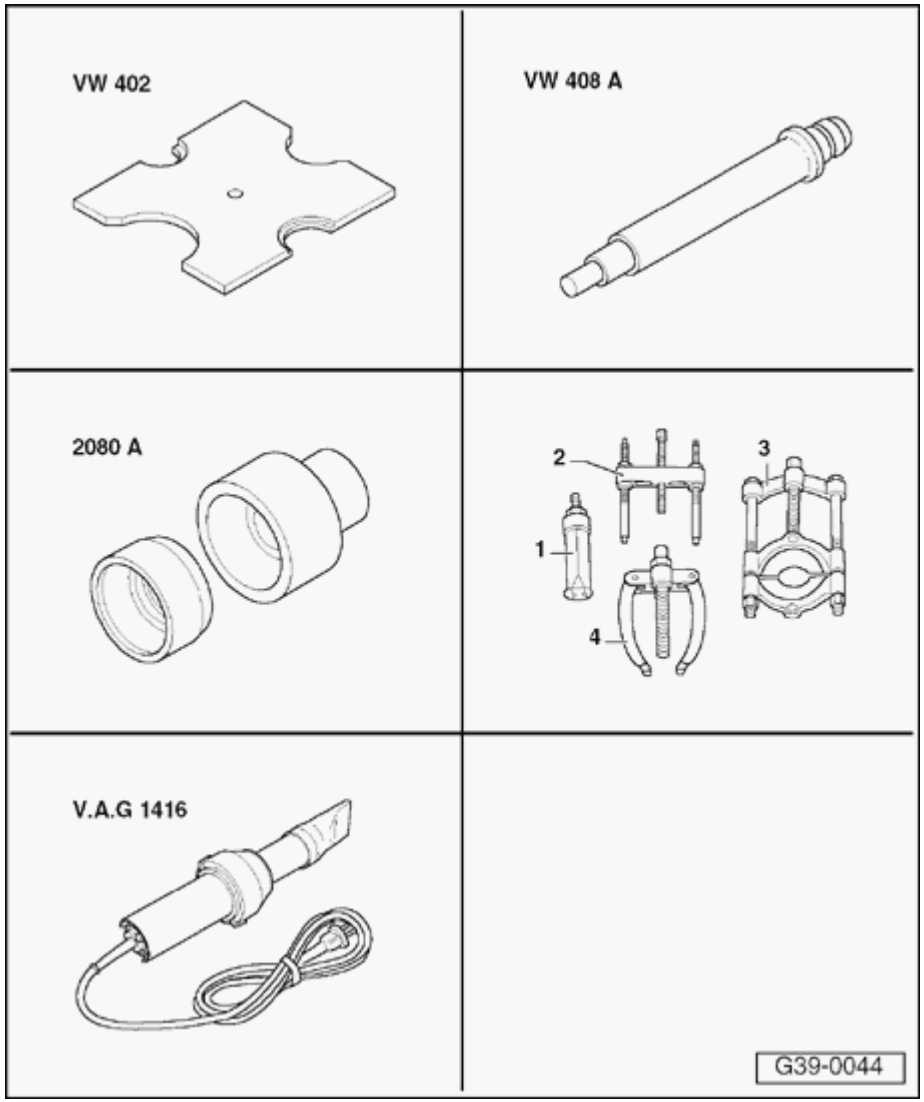
- Slide seal onto 3403 thrust piece.
- Drive seal in up to 3403 thrust piece stop.

- Completely cover splines on end of shaft (arrow) with insulating tape without creasing or overlapping the tape, to prevent damage to seal when sliding on drive pinion.
- Install drive pinion on center of output shaft. (Installed position ⇒ page 39-53)

Note:

If installing the intermediate flange on the output shaft carelessly, the sealing lips of the seal can be damaged.

39-69



Needle bearing for spur gear 2, replacing

Special tools and equipment

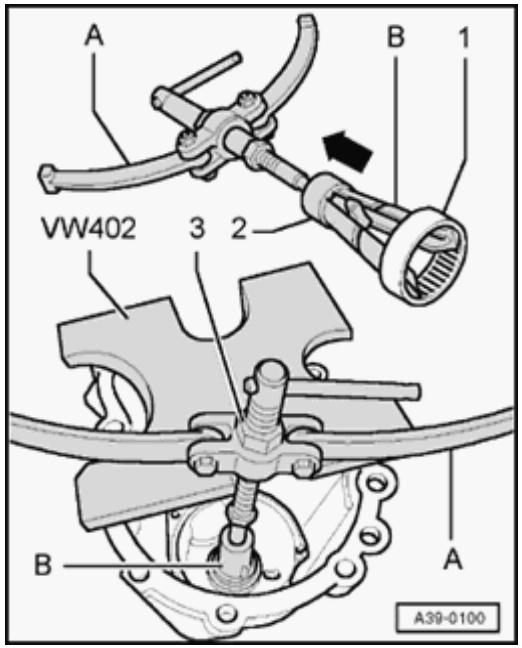
- VW402 thrust plate
- VW408A punch
- Press sleeve for 2080A sleeve
- Item 1 Kukko 21/4 extractor
- Item 3 Kukko 22/1 support
- VAG1416 hot air blower

39-70

Removing

- Remove center differential ⇒ page 39-56 .

Note:

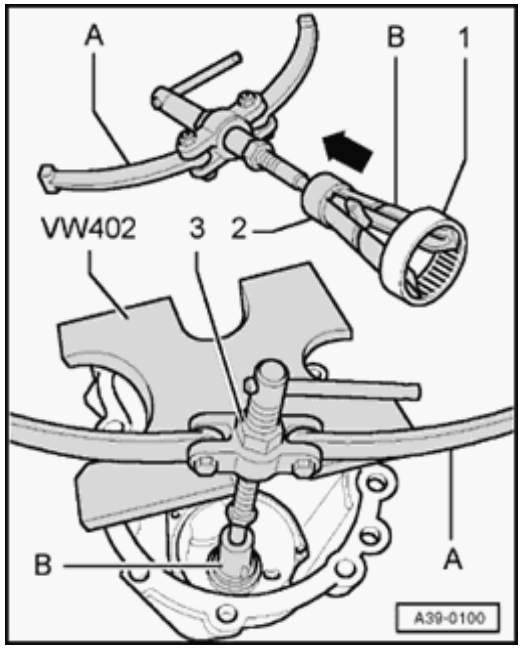


The upper part of the illustration shows how the pulling hooks of extractor -B- must be inserted into needle bearing -1-.

- Slide centering sleeve -2- of extractor -B- approx. 4 mm in direction of arrow in order to be able to open pulling hooks of extractor far enough.

A - Support e.g. Kukko 22/1

39-71



- Spread extractor -B- into upper lip of needle bearing -1- and secure extractor at nut.
- Install retainer -A- on extractor -B- as illustrated.
- Support retainer -A- using VW402 thrust plate and pre-tension at nut 3 of retainer.
- Using commercially available hot air blower, quickly heat up outside of transfer housing in vicinity of needle bearing seat to approx. 100 ° C.

WARNING!

Wear protective gloves!

- Quickly pull out needle bearing.

Installing

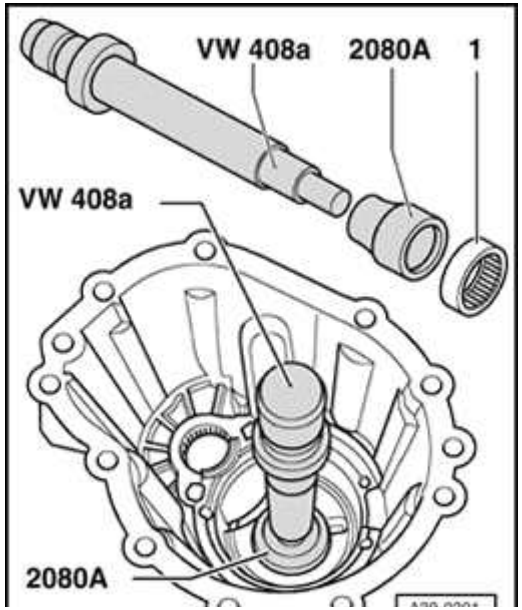
Installation is the reverse of removal. Also carry out the following procedure.

- Check needle bearing seat in transfer housing for damage, rework if necessary.

- Using commercially available hot air blower, uniformly heat up outside of transfer housing in vicinity of needle bearing seat to approx. 100 ° C.

WARNING!

Wear protective gloves!



- Place 2080A sleeve onto new needle bearing -1-.
- Drive needle bearing into transfer housing up to stop using VW408A punch.

39-52

Ring gear, adjusting

(Adjusting differential)

Repairs after which the ring gear must be adjusted ⇒ Page 39-37 .

Special tools, testers and auxiliary items

- Drift VW 295
- Dial gauge extension VW 382/10
- Measuring plate VW 385/17
- Universal dial gauge bracket VW 387
- Measuring lever VW 388
- Press plate VW 402
- Installing tool VW 459/2
- Ring gear adjusting device VW 521/4
- Attachment for adjusting device VW 521/8

39-53

- Thrust pad 3062
- Thrust plate 30-205
- Mandrel 30-505
- Torque gauge 0-600 Ncm
- Dial gauge
- Dial gauge extension

39-54

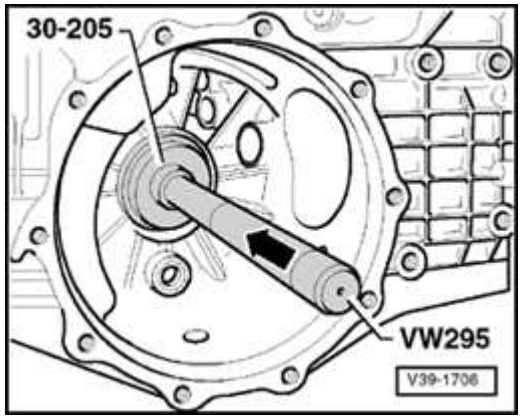
Determining total shim thickness "S_{total}" for shims "S1" + "S2"

(Setting preload of tapered roller bearing for differential)

- Drive pinion removed

- Remove seal and outer races of both tapered roller bearings for differential.

- Remove shims ⇒ Page 39-18 .

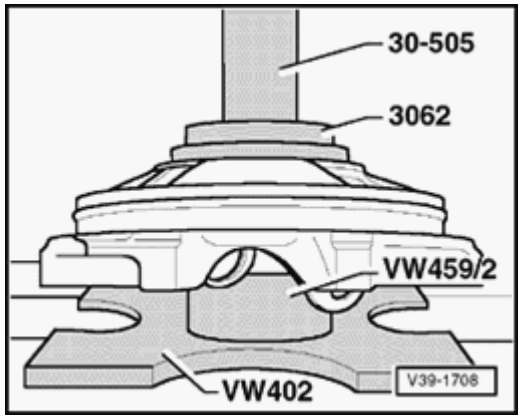


- Drive outer race for tapered roller bearing with shim "S2" into transmission housing. For measurement purposes an "S2*" shim 1.20 mm thick (2 shims of 0.60 mm) is used.

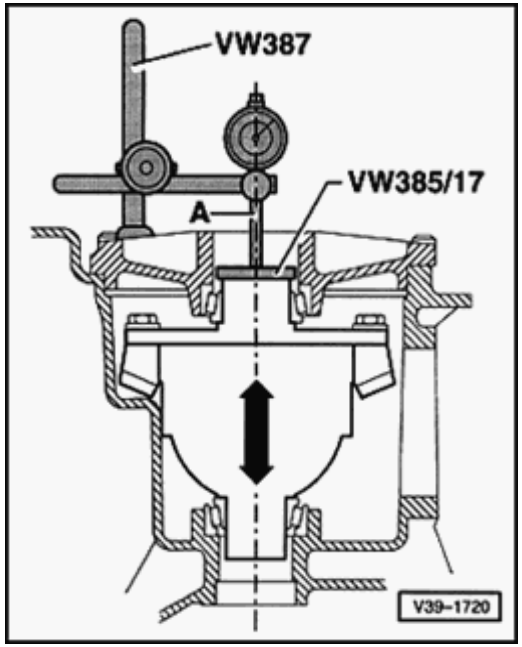
Note:

For measurement purposes a shim "S2" of 1.20 mm is initially inserted which is designated "S2" in the following. After determining backlash, "S2*" will be replaced by the correct shim "S2."*

39-55



- Press outer race for tapered roller bearing without shim "S1" into cover for differential.
- Insert differential without drive wheel for speedometer sender -G22 into transmission housing. Ring gear is positioned on left-hand side (same side as cover for final drive).
- Install cover for differential with 4 bolts (25 Nm).
- Position transmission so that cover for differential faces up.
- Turn differential 5 turns in both directions so that tapered roller bearings settle.



- Assemble measuring equipment, use a 30 mm dial gauge extension.
- Set dial gauge (3 mm measuring range) -A- to "0" with 2 mm preload.

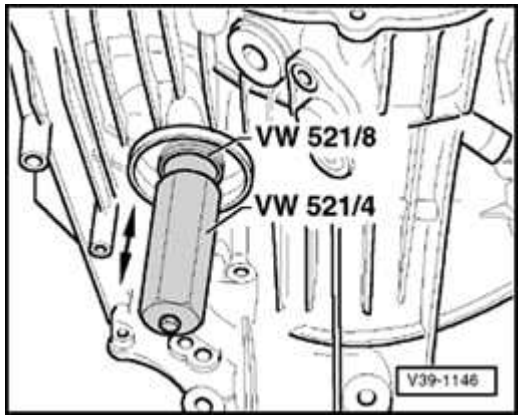
Note:

The tip of the dial gauge must be positioned on center of differential.

- Lift differential, without turning, and read off play on dial gauge.

• Measurement in following example: 0.62 mm.

39-56



Note:

- *Secure special tools VW 521/4 and VW 521/8 on right of differential (transmission side) to lift differential.*
- *If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the tapered roller bearing.*

Formula:

"S_{total}" = "S2*" + measurement + bearing preload

Example:

	Inserted shim(s) "S2*"	1.20 mm
+	Measured value	0.62 mm
+	Bearing preload (constant)	0.25 mm
=	Total shim thickness "S_{total}"	
	for "S1" + "S2"	2.07 mm

39-57

Determining thickness of shim "S1*"

Note:

- *The preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.*

- *The total shim thickness "S_{total}" remains unchanged.*

Formula:

"S1*" = "S_{total}" - "S2*"

Example:

	Total shim thickness "S_{total}"	
	for "S1" + "S2"	2.07 mm
-	Inserted shim(s) "S2*"	1.20 mm
=	Thickness of shim "S1*"	0.87 mm

39-58

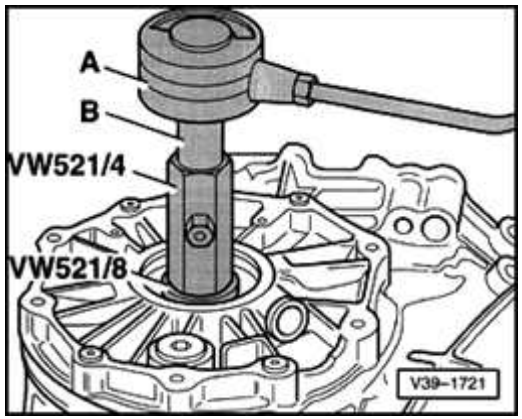
Measuring friction torque (check)

Note:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "S_{total}."*

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- Drive pinion removed



- Fit torque gauge 0-600 Ncm -A- onto differential.

B - Socket

- Read off frictional torque.

Frictional torque specifications:

New bearings	Used bearings
200-350 Ncm	30-50 Ncm

Note:

If the final drive set (drive pinion and ring gear) is being adjusted, perform the adjustment of the drive pinion now and check the adjustment ⇒ Page 39-39 .

39-59

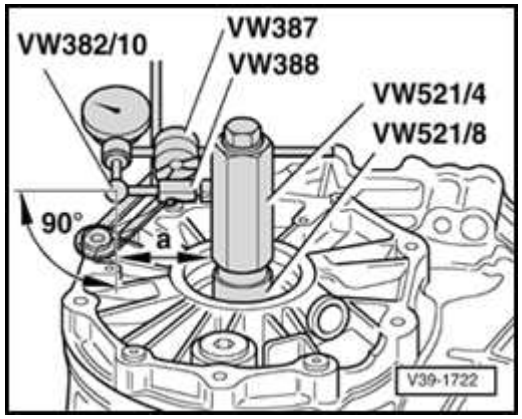
Measuring backlash

(Position of ring gear in transmission housing)

- Drive pinion with shims "S3" and "S4" installed

- Install differential.

- Turn differential 5 turns in each direction to settle tapered roller bearings.



- Secure dial gauge retainer VW 387 onto housing.
- Insert adjustment device VW 521/4 and VW 521/8 for ring gear.
- Fit dial gauge with dial gauge extension VW 382/10 (6 mm flat).
- Set measuring lever VW 388 to dimension a = 79 mm.
- Determine play between the teeth flanks as follows:
  - Turn ring gear until it makes contact with a tooth flank (end of backlash travel).
  - Set dial gauge to "0" with 2 mm preload.
  - Turn ring gear back until lying against an opposite tooth flank (backlash).

- Read off backlash and note value.

- Turn ring gear through 90° and repeat measurements a further 3 times.

Note:

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

Determining average backlash

- Add the four measurements together and divide by four.

Example:

	1st measurement	0.49 mm
+	2nd measurement	0.48 mm
+	3rd measurement	0.50 mm
+	4th measurement	0.49 mm
=	Sum of measured values	1.96 mm

- Result: The average backlash is 1.96 ÷ 4 = 0.49 mm

Determining thickness of shim"S2"

Formula:

"S2" = "S2*" - backlash + lift

Example:

	Inserted shim "S2*"	1.20 mm
-	Average backlash	0.49 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim "S2"	0.86 mm

- Determine shim(s) from table.

⇒ *Parts catalog*

The following shims are available for "S2"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	
0.60	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-62

Determining thickness of shim "S1"

Formula:

"S1" = "S_{total}" - "S2"

Example:

	Total shim thickness "S_{total}" for "S1" + "S2"	2.07 mm
-	Thickness of shim "S2"	0.86 mm
=	Thickness of shim "S1"	1.21 mm

- Determine shim(s) from table.

⇒ *Parts catalog*

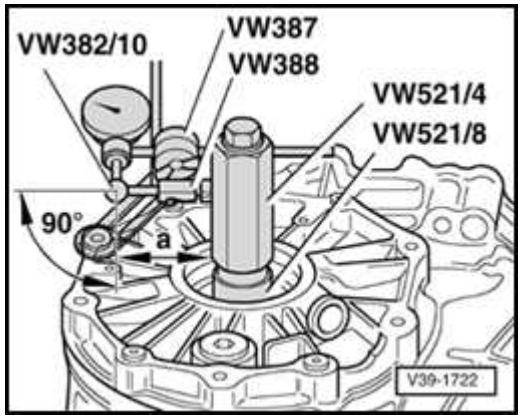
The following shims are available for "S1"

Shim thickness (mm) 1)		
0.45	0.65	0.85
0.50	0.70	0.90
0.55	0.75	

0.60	0.80	

[1)] Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-63



Performing check measurement

- After installing shims "S1" and "S2," turn differential 5 turns in both directions so that the tapered roller bearings settle.
- Measure backlash four times on circumference.

  Specifications: 0.12-0.22 mm

Note:

- *If the backlash lies outside the tolerances, the adjustments must be repeated. But the total shim thickness "S_{total}" must remain the same.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

39-64

Driveshaft, servicing

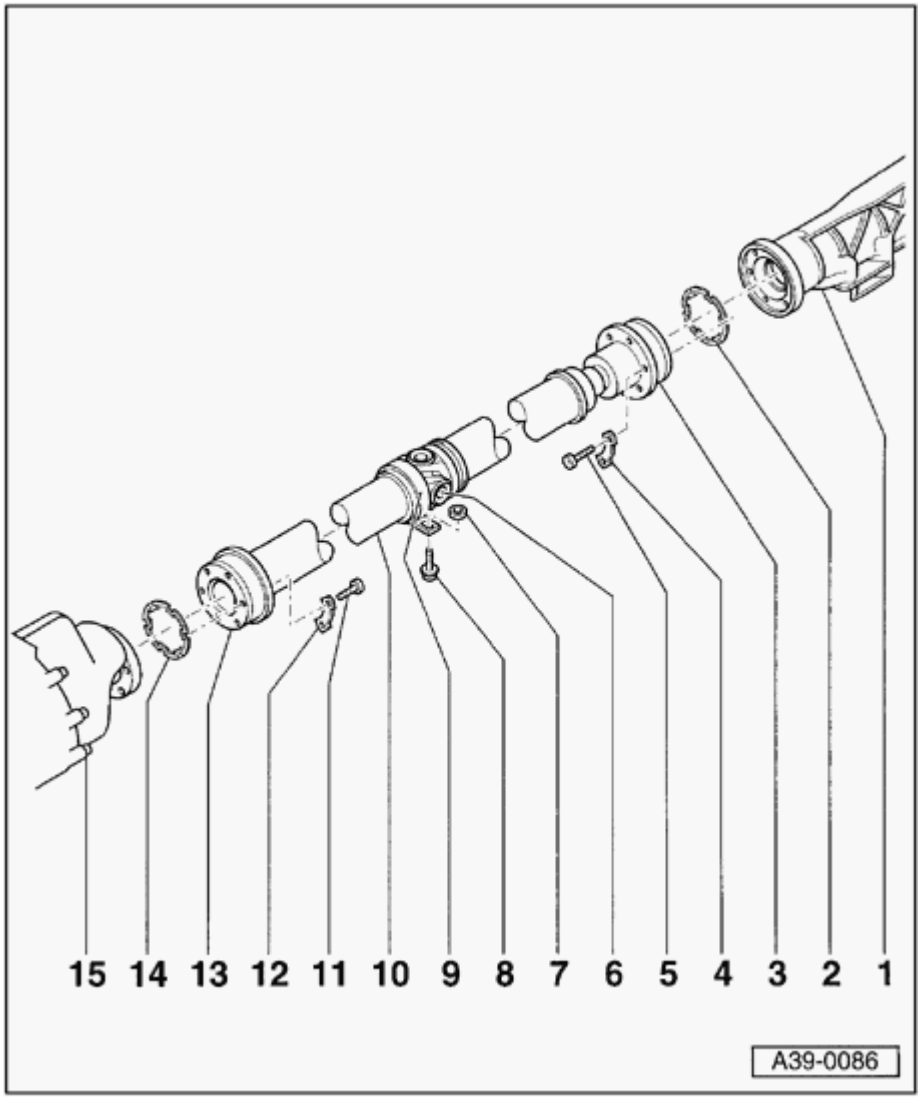
Note:

- *Observe general repair instructions ⇒ Page 00-11 .*
- *Do not bend the driveshaft more than 25° at the central joint, otherwise the universal joint will be damaged.*
- *Only store and transport driveshaft extended.*
- *No repair work can be carried out on the driveshaft with the exception of removing, installing and adjusting.*
- *If the driveshaft is only detached at the transmission or from rear final drive then the driveshaft is to be tied-up or supported at the constant velocity joint.*
- *Before removing, mark the position of the rear driveshaft joint in relation to the flange on the rear final drive. Reinstall in the same position, otherwise this can cause excessive imbalance, bearing damage and droning noise.*
- *If complaints are received (noises, vibrations), it*

is essential to check whether correct adjustment of the driveshaft rectifies the fault before replacing the driveshaft.

- *After removing the driveshaft from the rear final drive, the additional balance disc (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled.*

39-65



1 - Rear final drive

2 - Gasket

- Always replace
- Pull off backing foil, and stick self-adhesive side of gasket to drive flange.
- Remove grease from drive flange

3 - Constant velocity joint

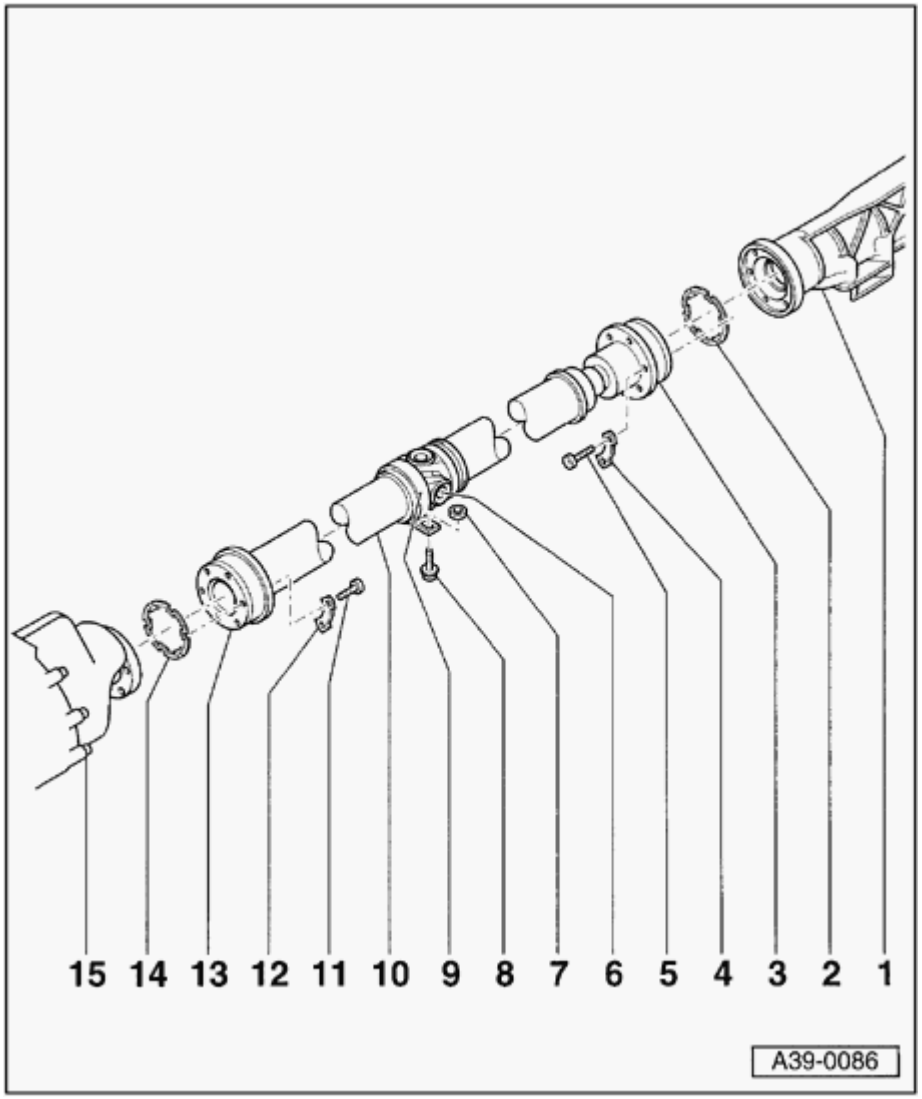
- Maximum permissible angle of deflection 8°

4 - Lock plate

5 - Hex socket head bolt, 55 Nm

- Self-locking
- Always replace
- Threads for bolts in drive flanges must always be cleaned (e.g. with a thread tap)

39-66



6 - Universal joint

- Maximum permissible angle of deflection 25°

7 - Shim

- Determining thickness ⇒ Page 39-76

8 - Hex bolt, 23 Nm

9 - Driveshaft center mounting

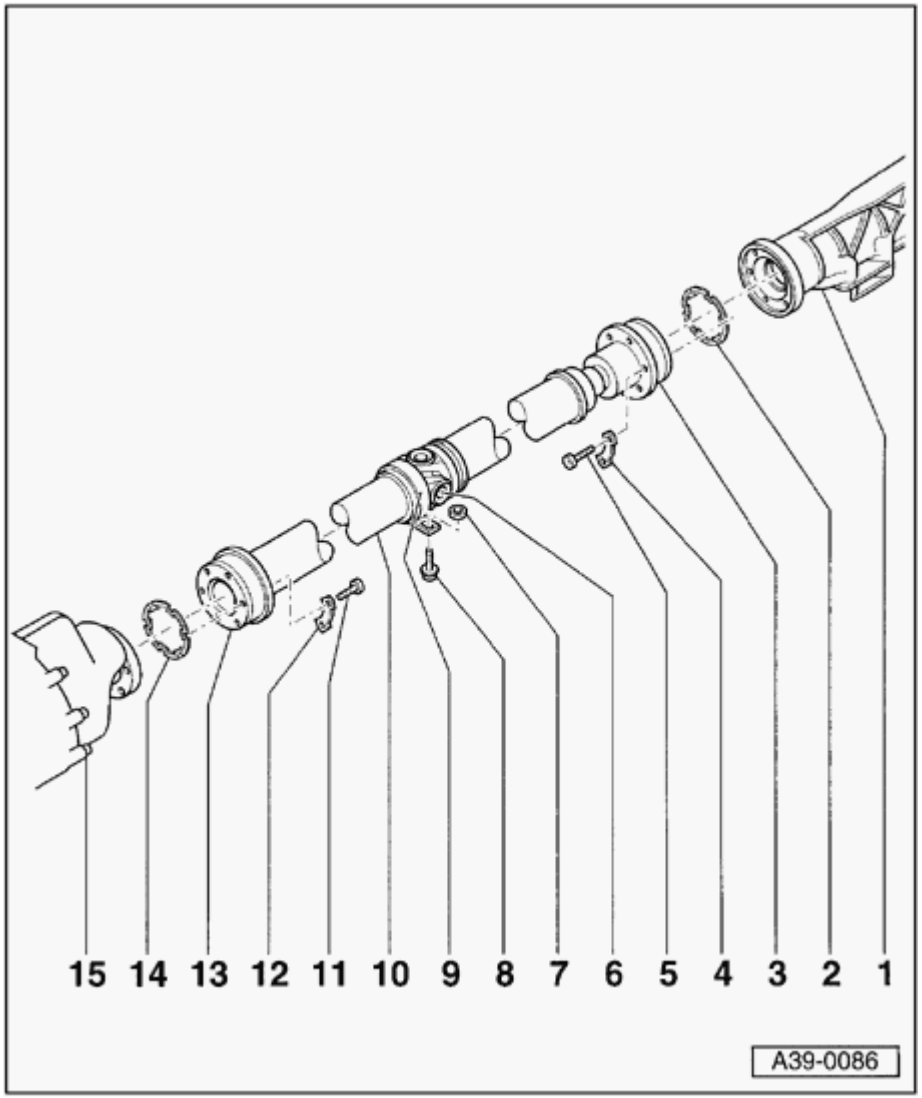
10 - Driveshaft

- Adjusting ⇒ Page 39-75

11 - Hex socket head bolt, 55 Nm

- Self-locking
- Always replace
- Threads for bolts in drive flanges must always be cleaned (e.g. with a thread tap)

39-67



12 - Lock plate

13 - Constant velocity joint

- Maximum permissible angle of deflection 8°

14 - Gasket

- Always replace
- Pull off backing foil, and stick self-adhesive side of gasket to drive flange.
- Remove grease from drive flange

15 - Transmission

39-68

Driveshaft, removing and installing

Special tools, testers and auxiliary items

- Assembly appliance 3405

- Observe notes ⇒ Page 39-64 .

Removing

- If fitted, remove cross piece below exhaust system.

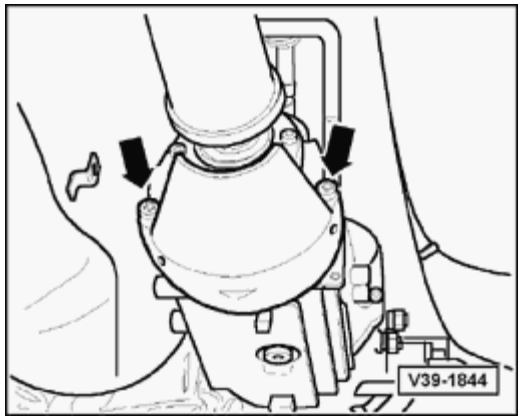
- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

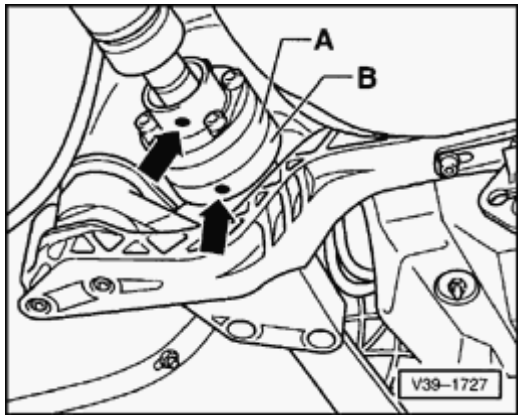
39-69

Removing

- Remove heat shields above driveshaft.



- Remove heat shield for driveshaft from cover for Torsen differential (arrows).



- Check whether there is a factory marking (paint spots (arrows)) on the driveshaft flange and the flange on the rear final drive. If not, mark the position of the driveshaft flange -A- in relation to the rear final drive (arrow -B-) with paint.

Note:

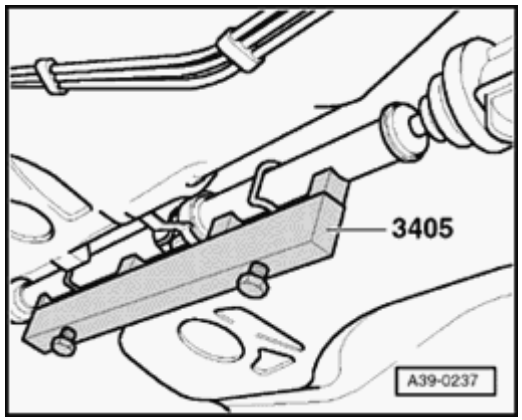
Only mark if the same driveshaft is to be reinstalled.

39-70

- Loosen securing bolts on both driveshaft flanges.

- Unscrew three upper securing bolts on each driveshaft constant velocity joint.

- Loosen securing bolts of center driveshaft mounting slightly.



- Attach assembly appliance 3405 and tighten the plastic nuts.

Note:

Never fit assembly appliance onto balance plates.

- Remove securing bolts of flange to transmission and to rear final drive as well as securing bolts of center driveshaft mounting.
- Slide driveshaft together toward rear final drive. Constant velocity joints move along their axis.
- Guide out driveshaft with assembly appliance past transmission flange.

Note:

Only transport and store driveshaft when extended.

Installing

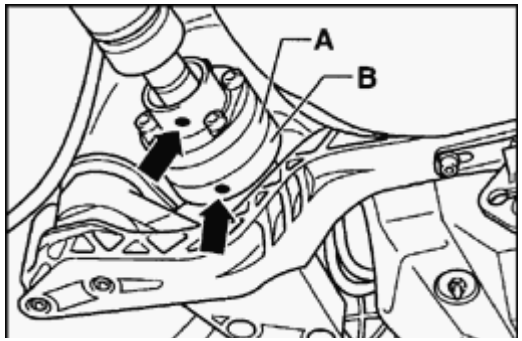
Installation is carried out in the reverse order, when doing this note the following:

Note:

- *It is essential that the locking fluid remaining in the threads in the drive flanges on the transmission and rear final drive is cleaned out after removing the driveshaft. Otherwise there is a danger that the new bolts will seize when they are screwed in and then shear if they have to removed later.*

- *The threaded holes can be cleaned with a thread tap.*

- *Replace the gaskets on the drive flanges (remove backing foil and stick gaskets onto drive flange; make sure that the surfaces are free of grease).*



- *To prevent imbalance, the flanges on the driveshaft -A- and on the rear final drive -B- must be installed so that the factory markings (or the markings made on removal) are in alignment (arrows).*

- *If a new driveshaft is being installed and the factory paint marking on the rear final drive flange is no longer visible, the radial run-out at the flange for the driveshaft must be measured ⇒ Page 39-73 , and the paint marking on the driveshaft must be aligned with the marking on*

the flange.

- *After removing the driveshaft from the rear final drive, the additional balance disk (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled. Always replace all flange bolts after disassembling.*
- *Replace driveshaft bolts (self-locking).*

- Adjust driveshaft after installing ⇒ Page 39-75 .

- Align exhaust system free of stress.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26; Removing and installing parts of exhaust system*

Tightening torques

Component	**Nm**
Driveshaft to transmission (output flange)	55
Driveshaft to final drive (input flange)	55
Driveshaft center mounting to body	23
Heat shield for driveshaft to transmission	23
Cross member to body	25
Nuts for clamp	40

39-73

Radial run-out at driveshaft flange and marking, measuring

Special tools, testers and auxiliary items

- Universal dial gauge bracket VW 387
- Lifting tackle 2024 A
- Dial gauge
- M10 x 85 bolt

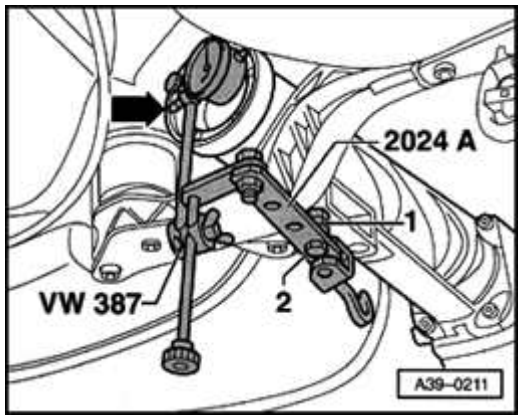
Note:

- *The radial run-out must always be measured when the drive flange housing is removed. Remove old paint marking and make new marking.*
- *If a new driveshaft is being installed and the marking on the drive flange of the rear final drive is no longer visible, the point of maximum radial run-out must be measured with a dial gauge and marked with paint.*
- *The paint marking on the driveshaft is then brought into alignment with this paint marking*

⇒ *Page 39-71* .

- *The radial run-out can be measured when the rear final drive is installed, but the driveshaft must be disconnected at the rear final drive. Observe notes* ⇒ *Page 39-64* .

39-74



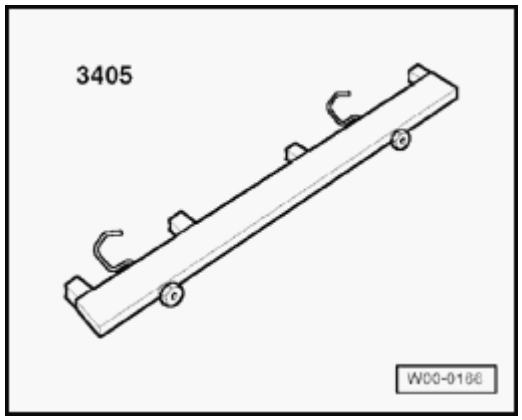
- Remove bolt on front left of rear final drive support.

- Remove bar from lifting appliance 2024 A and secure it to free hole with an M10 x 85 mm bolt -2-. Use approx. 5 M12 nuts -1- as spacers.
- Secure dial gauge bracket VW 387 to the bar when it is secured in position.
- Position dial gauge on ground circumference in driveshaft flange (arrow) and set to zero with a preload of 1 mm.
- Turn differential via both rear wheels (left and right drive flanges) until flange on rear final drive completes one rotation.
- Make a paint marking at point of greatest radial run-out on outside of flange (= greatest distance from axis of rotation).
- Remove old marks on driveshaft flange.
- Install driveshaft ⇒ Page 39-71 .

39-75

Driveshaft, adjusting

Special tools, testers and auxiliary items



- Assembly appliance 3405

- Observe notes ⇒ Page 39-64 .

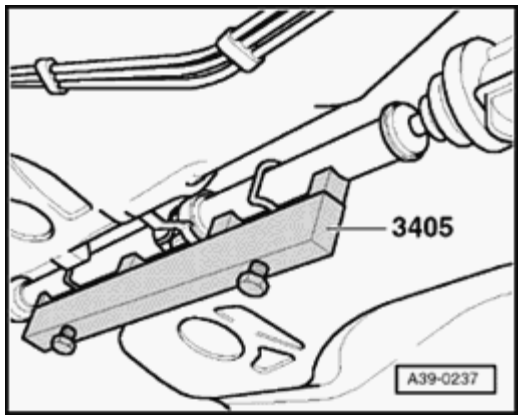
Adjustments should be carried out with care, because a badly adjusted driveshaft is often the cause of vibration and droning.

- If fitted, remove cross-piece below exhaust system.
- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Remove heat shields above driveshaft.

- Loosen securing bolts of center driveshaft mounting slightly.

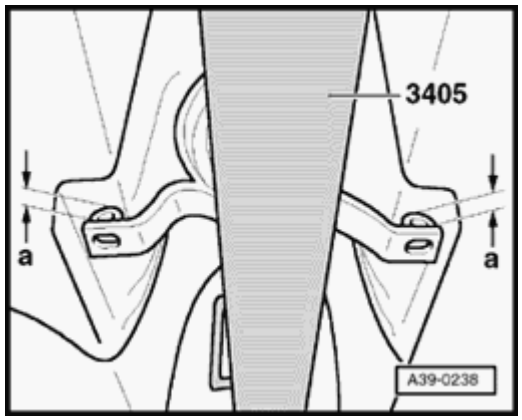


- Attach assembly appliance 3405 and tighten the plastic nuts.

Note:

Never fit assembly appliance onto balance plates.

- Remove securing bolts and shims from center mounting.



- Align center driveshaft mounting so that distance -a- is the same on left and right.
- Measure -a- on both sides.
- Select shims from table.

⇒ *Parts catalog*

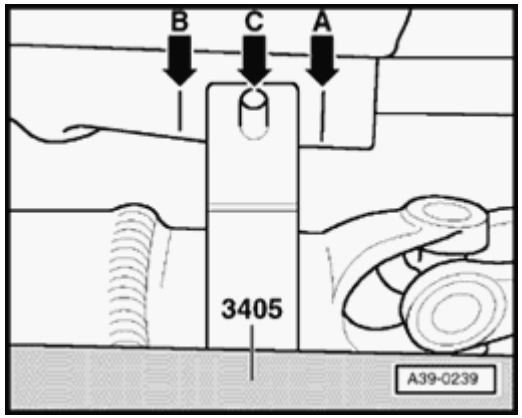
39-77

The following shims are available:

Dimension -a- (mm)	Shim thickness (mm)
0-3.0	-
3.1-5.0	2
5.1-7.0	4
7.1-9.0	6
9.1-11.0	8
11.1-13.0	10

- Install the correct shims on both sides.

39-78



Aligning driveshaft longitudinally

- Using assembly appliance, push driveshaft toward rear as far as it will go.
- Mark position of center mounting on body (arrow -A-).
- Using assembly appliance, push driveshaft toward front as far as it will go.
- Mark position of center mounting on body (arrow -B-).
- Align driveshaft -arrow C-.
  - The center mounting must be positioned centrally between the markings -A- and -B-
- Install securing bolts of driveshaft center mounting and previously determined shims and tighten.
- Remove assembly appliance.
- Install heat shield above driveshaft.

39-79

The remaining installation steps are carried out in the reverse order of removal. Note the following points:

- Align exhaust system free of stress.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

Tightening torques

Component	Nm
Driveshaft center mounting to body	23
Cross member to body	25
Nuts for clamps	40

39-68

Driveshaft, servicing

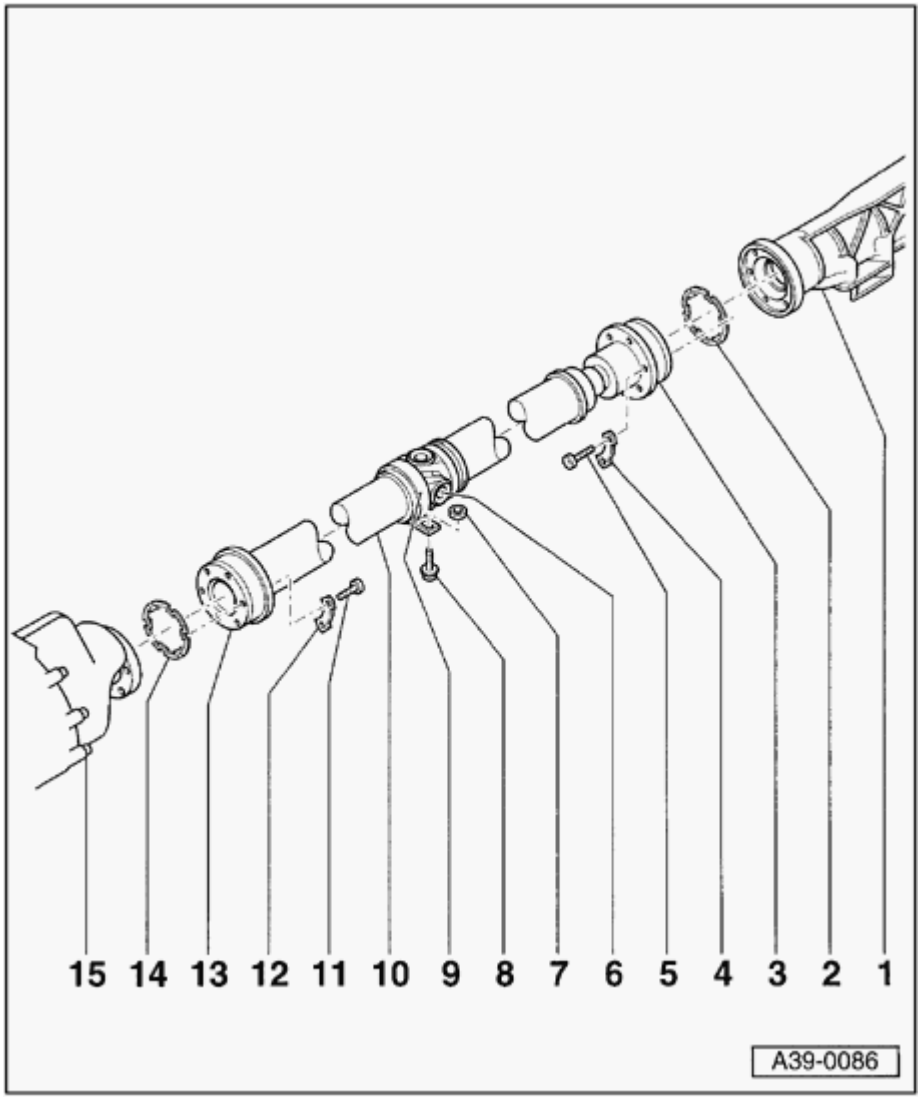
CAUTION!

- ***Refer to general repair instructions ⇒ Page 00-14 .***
- ***Do not bend the driveshaft more than 25° at the center universal joint, otherwise the universal joint could be damaged.***
- ***Only store and transport the driveshaft extended.***
- ***No repair work can be carried out on the driveshaft with the exception of removing, installing and adjusting.***
- ***If the driveshaft is only detached at the transmission or from the rear final drive, it must be tied up or supported at the constant velocity joints.***
- ***Before removing, mark the position of the joint to flange. Reinstall in the same position otherwise imbalance will be excessive, the mountings could be damaged causing rumbling noises.***

- ***For complaints (noise or vibrations), first check whether correct adjustment of the driveshaft resolves the problem before replacing the driveshaft.***

- ***After removing the driveshaft from the rear final drive, do not reinstall additional balance disc (thicker washer) which may have been installed between base plate and bolt head.***

39-69



1 - Final drive

2 - Gasket

- Always replace
- Pull off backing foil, and attach self-adhesive side of gasket to drive flange.
- De-grease drive flange

3 - Constant Velocity (CV) joint

- Maximum permissible bend angle 8°

4 - Backing plate

5 - Socket-head bolt

- Always replace
- Self-locking
- 55 Nm (41 ft lb)
- Bolt threads in drive flanges must always be cleaned (e.g. with thread tap)

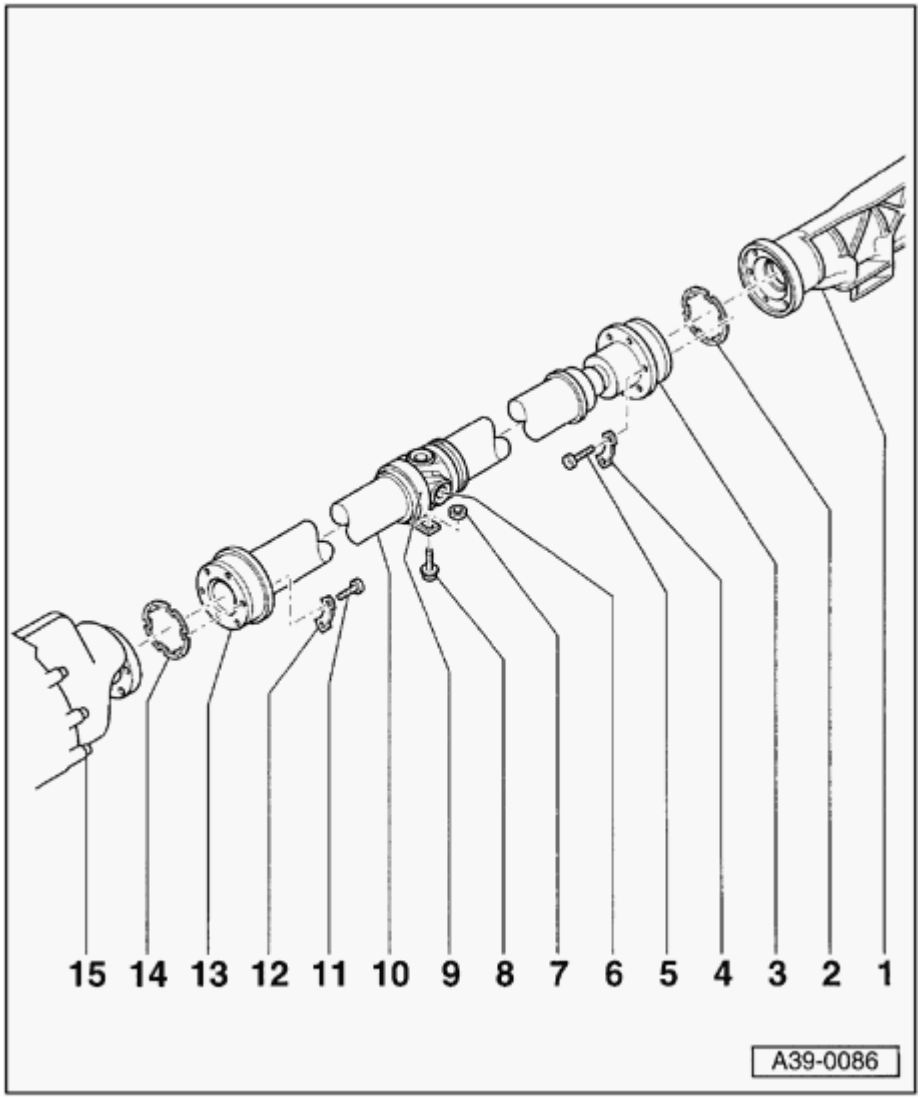
6 - Universal joint

- Max permissible bend angle 25°

7 - Shim

- Determining thickness ⇒ Page 39-79

39-70



8 - Hex bolt

- 23 Nm (17 ft lb)

9 - Driveshaft center bearing

10 - 14Driveshaft

- Adjusting ⇒ Page 39-79

11 - 16Socket-head bolt

- Always replace
- Self-locking
- 55 Nm (41 ft lb)
- Bolt threads in drive flanges must always be cleaned (e.g. with thread tap)

12 - Backing plate

13 - Constant Velocity (CV) joint

- Max. permissible bend angle 8°

14 - Gasket

- Always replace
- Pull off backing foil, and attach self-adhesive side of gasket to drive flange.
- De-grease drive flange

15 - Transmission

39-71

Driveshaft, removing and installing

Special tools and equipment

- 3298 alignment fixture for all wheel drive driveshaft
- 3139/2 adapter

- Observe all cautions ⇒ Page 39-68 .

Removing

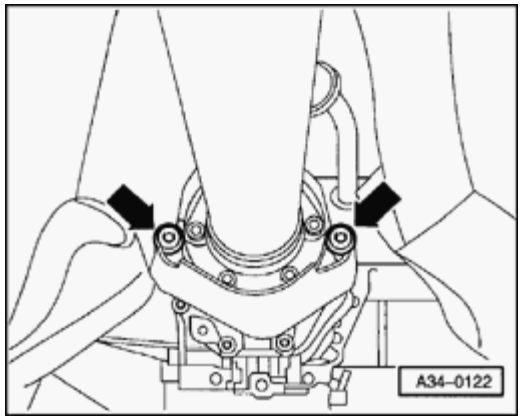
- Remove crossmember under exhaust system (if installed).
- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

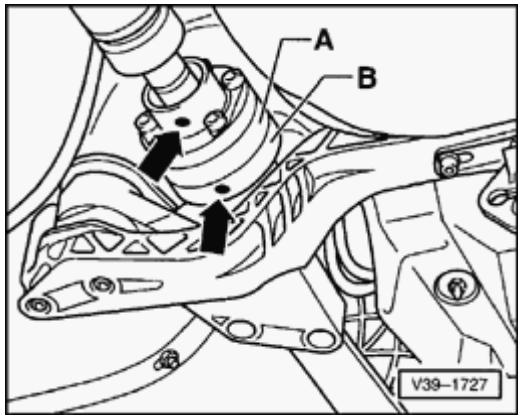
39-72

Removing

- Remove heat shield above driveshaft.



- Remove heat shield for driveshaft from cover of Torsen differential (arrows).



- Check for factory color markings marked on driveshaft and driveshaft/flange at rear final drive drive flange. If not, mark position of driveshaft flange (arrow -A-) in relation to drive flange final drive (arrow -B-) with paint.

Note:

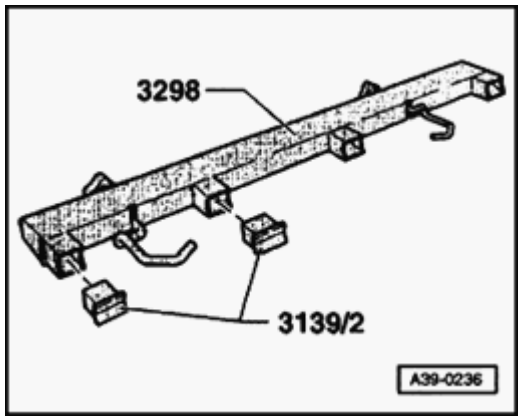
Marking the shaft is only necessary if the same driveshaft will be re-installed.

- Loosen mounting bolts of both driveshaft flanges.

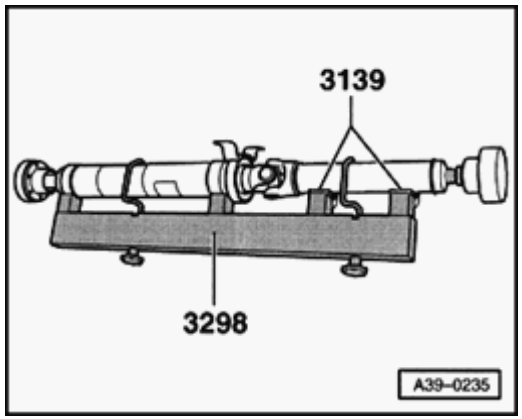
39-73

- Remove three upper mounting bolts on each driveshaft constant velocity joint.

- Loosen mounting bolts of center bearing slightly.



- Install two 3139/2 adapters, in 3298 alignment fixture.



- Mount 3298 alignment fixture with both 3139/2 adapters and tighten plastic nuts.

Note:

Never install alignment fixture onto balance plates.

- Remove mounting bolts of flanges to transmission and to final drive as well as mounting bolts for center bearing.
- Push driveshaft together toward final drive. CV joints can be moved axially.

- Remove driveshaft at transmission drive flange using assembly tool.

Note:

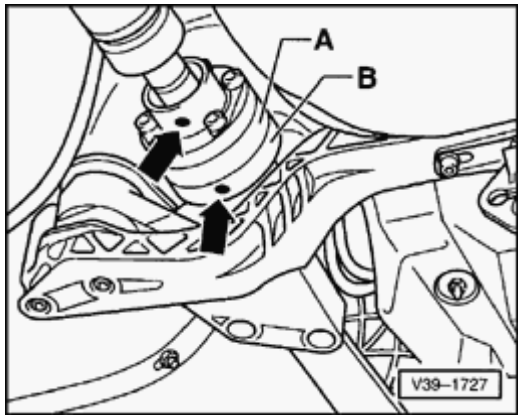
Driveshaft must always be kept in extended position for transportation and storage.

Installing

Installation is the reverse of removal, note the following:

Notes:

- *The threaded holes on the drive flange of the transmission and the final drive should be cleaned of all locking compound residue after the driveshaft has been removed. Otherwise there is a risk of seizing a bolt when tightening and subsequently break off at the next disassembly.*
- *Clean by using a thread tap.*
- *Replace seals on drive flanges. Pull off backing foil, and attach self-adhesive side of gasket to drive flange. Adhesive bonding surface must be free of grease.*



Notes continued:

- *To prevent imbalance, the flanges of the driveshaft (arrow -A-) and of the final drive (arrow -B-) must be installed so that the factory color markings (or the markings made during removal) are aligned.*
- *If a new driveshaft is being installed and the factory color marking on the rear final drive flange is no longer visible, the radial deviation at the flange for the driveshaft must be measured ⇒ Page 39-77 and the color marking on the driveshaft must be aligned with the color marking on the flange.*
- *After removing the driveshaft from the final drive, additional balance disc (thicker washer) which may have been installed between base plate and bolt head may not be re-installed.*
- *Always replace self-locking driveshaft bolts.*

- After installing, adjust driveshaft ⇒ Page 39-79 .

- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component	Tightening torque
Driveshaft to transmission	55 Nm (41 ft lb)
Driveshaft to final drive	55 Nm (41 ft lb)
Center driveshaft bearing to body	23 Nm (17 ft lb)
Heat shield for driveshaft to transmission	23 Nm (17 ft lb)
Front cross-piece below exhaust system to body	25 Nm (18 ft lb)
Nuts for exhaust pipe clamp	40 Nm (30 ft lb)

39-73

Driveshaft, servicing

Important notes

A distinction is made between two driveshafts:

- Driveshaft made of steel
- Driveshaft made of carbon fiber

Only carbon fiber driveshafts were installed up to November 1997.

Only steel driveshafts were installed from November 1997.

If the driveshaft is replaced, make sure a driveshaft with the same part number is installed. A carbon fiber driveshaft must not be replaced by a steel driveshaft and vice versa !

39-74

Specific notes for carbon fiber driveshafts:

WARNING!

Driveshaft made of carbon fiber

- ***do not impact / do not hit***
- ***do not drop***

If the surface is damaged, driveshaft must be replaced

Do not bend the driveshaft, maximum permissible bending angle is 25 °. Otherwise the universal joint may be damaged.

Only store and move driveshaft fully extended.

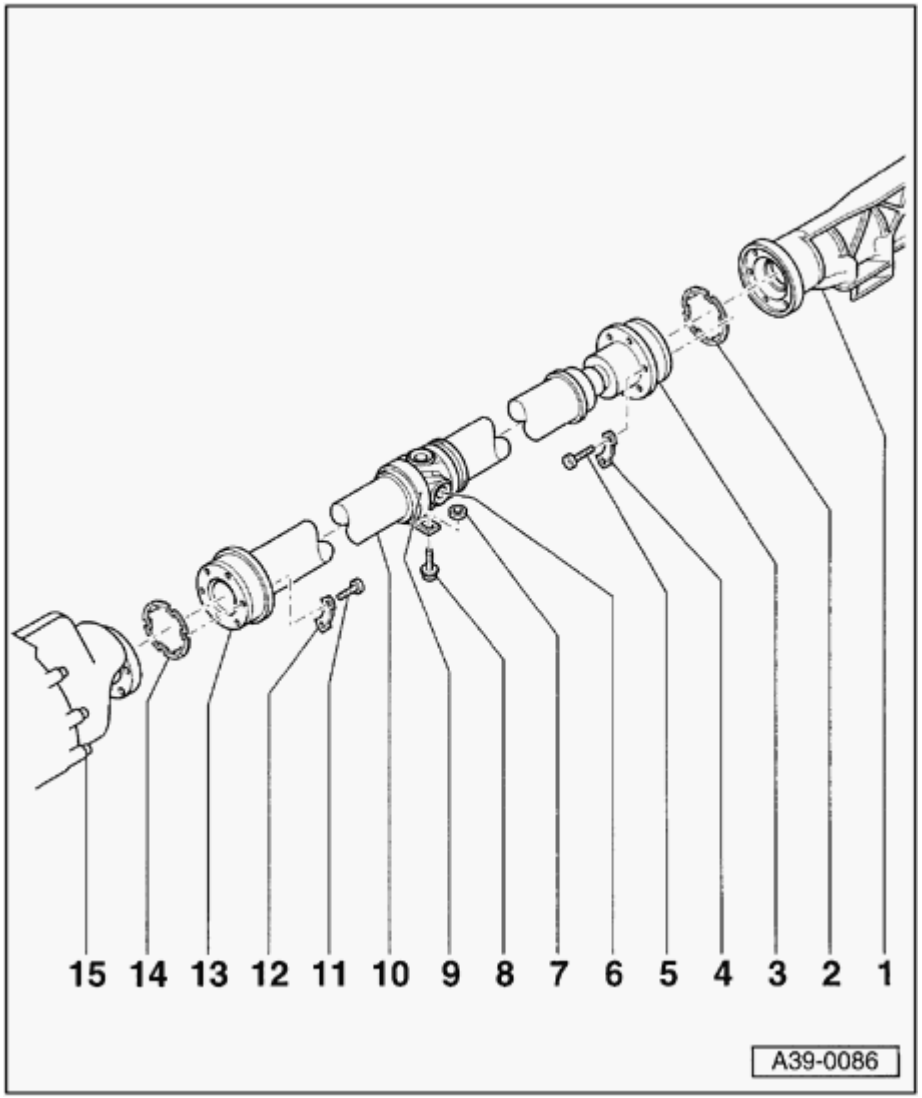
39-75

Notes for all driveshafts:

- *General repair notes ⇒ page 00-27 .*
- *Do not bend the driveshaft, maximum permissible bending angle is 25 °. Otherwise the universal joint may be damaged.*
- *Only store and move driveshaft fully extended.*
- *No repair work can be performed on the driveshaft with the exception of removing and installing and adjustment work.*
- *If the driveshaft is only detached at the transmission or from rear final drive, it must be tied up or supported at the constant velocity joints.*
- *Before removing, mark position from joint to flange. Reinstall in identical position otherwise imbalance will be too high which could result in damage to the bearing or in vibration noises.*
- *If there are complaints (noises, vibrations) it is essential to check whether correct adjustment of the driveshaft eliminates the symptoms before the driveshaft is replaced.*

- *After disconnecting driveshaft from rear final drive, an additional balance washer (thick washer) that may be located between shim and bolt head may not be reinstalled.*

39-76



1 - Rear final drive

2 - Gasket

- Always replace
- Remove protective film and attach self-locking side of gasket to drive flange.
- Degrease drive flange

3 - Constant velocity joint

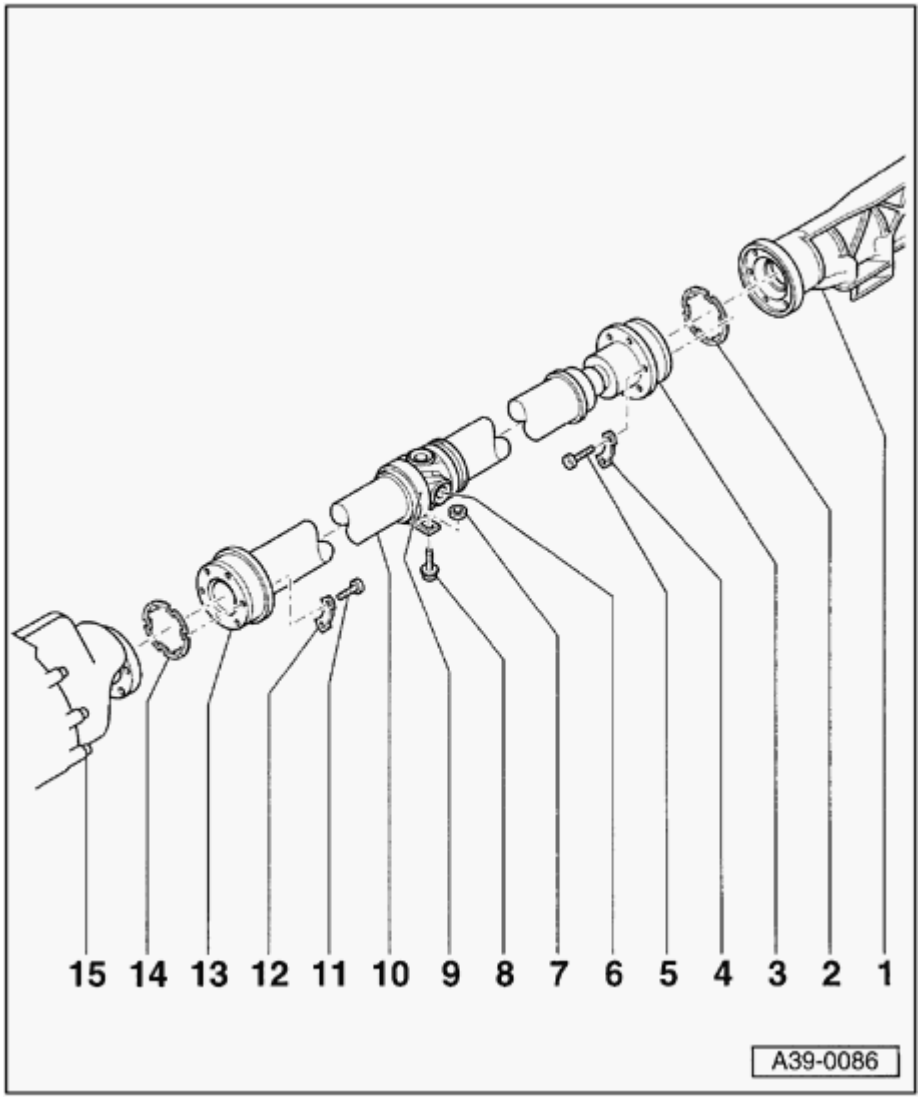
- Maximum permissible bending angle 8 °

4 - Backing plate

5 - Socket head bolt - 55 Nm

- Self-locking
- Always replace
- Always clean threaded holes for drive flange bolts (e.g. with thread cutter)

39-77



6 - Universal joint

- Maximum permissible bending angle 25 °

7 - Adjustment shim

- Determine thickness ⇒ page 39-90

8 - Hex-bolt - 23 Nm

9 - Center driveshaft bearing

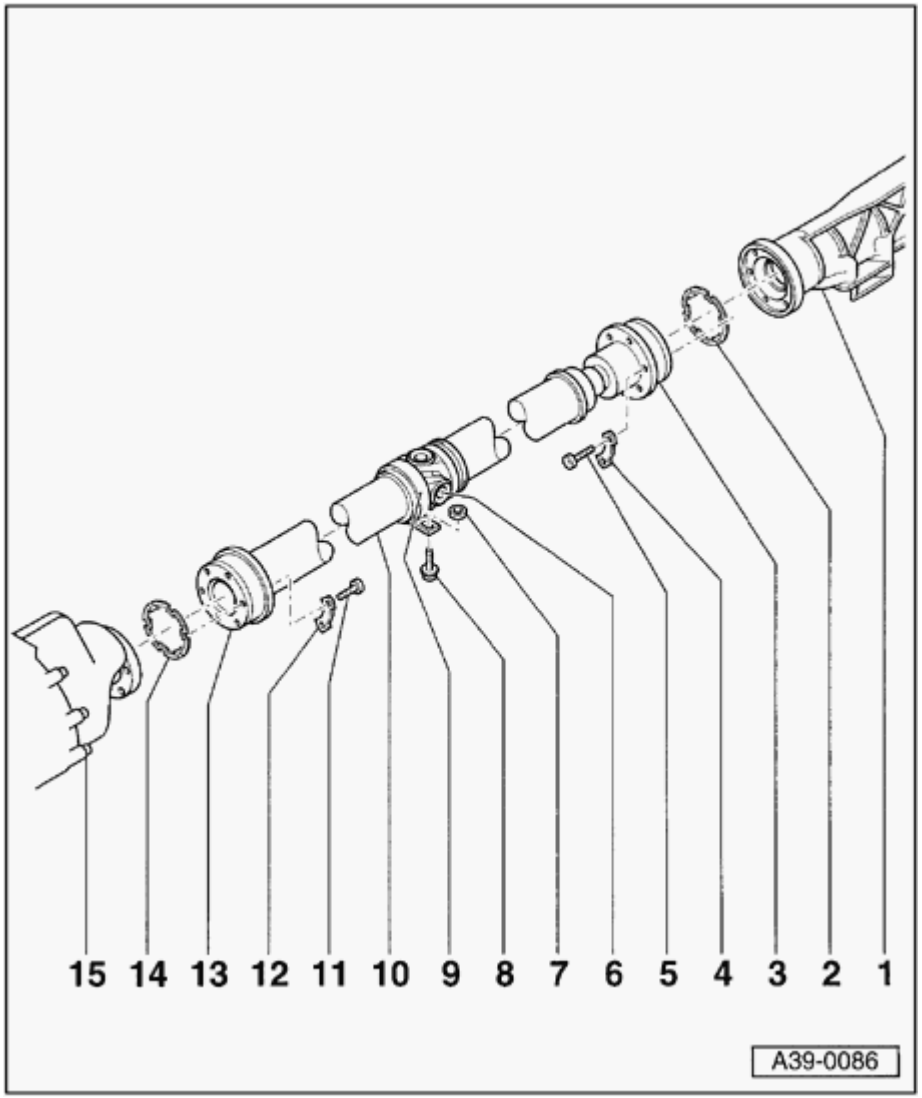
10 - Driveshaft

- Adjusting ⇒ page 39-88

11 - Socket head bolt - 55 Nm

- Self-locking
- Always replace
- Always clean threaded holes for drive flange bolts (e.g. with thread cutter)

39-78



12 - Backing plate

13 - Constant velocity joint

- Maximum permissible bending angle 8 °

14 - Gasket

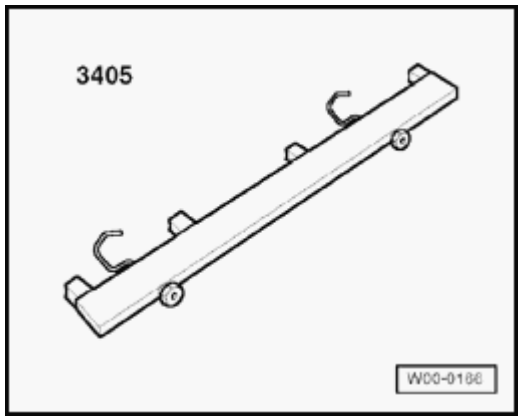
- Always replace
- Remove protective film and attach self-locking side of gasket to drive flange.
- Degrease drive flange

15 - Transmission

39-79

Driveshaft, removing and installing

Special tools and equipment



- 3405 alignment fixture

Removing

- Observe important notes ⇒ page 39-73
- Remove crossmember below exhaust system if installed.
- Remove front exhaust pipes:

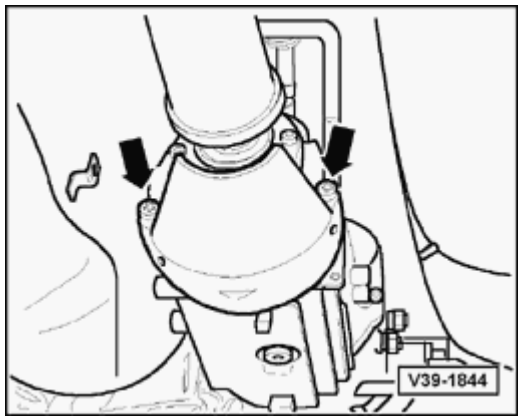
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Remove rear part of exhaust system starting at clamp to gain access to the driveshaft:

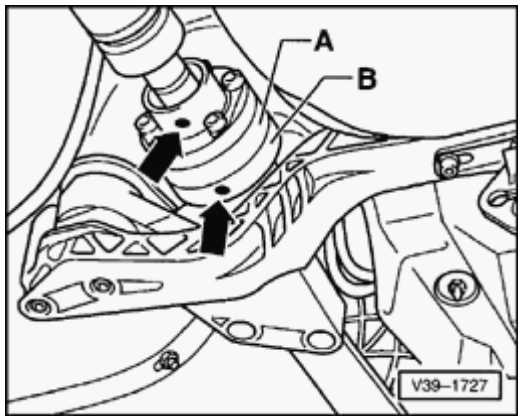
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

39-80

- Remove heat shields above driveshaft.



- Unbolt heat shield for driveshaft from cover for Torsen differential (arrows).



- Check whether there is a factory marking (colored dot -arrows-) on driveshaft and at flange/driveshaft at rear final drive. If not, mark location of driveshaft flange -A- to rear final drive -B- with color.

Note:

Only mark location, if same driveshaft is going to be reinstalled.

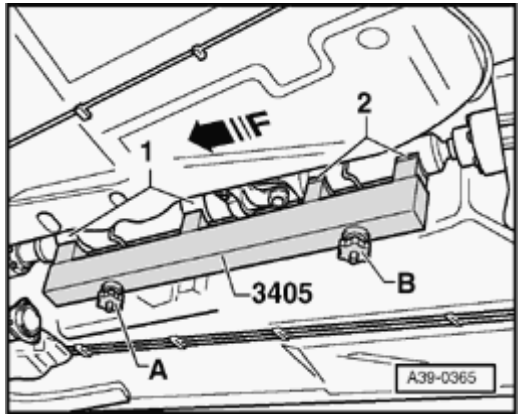
39-81

- Remove mounting bolts for both driveshaft flanges.

- Remove upper three mounting bolts for each driveshaft constant velocity joint.

- Back off mounting bolts for center support slightly.

Only for carbon fiber driveshafts:



- Place spacer pieces -2- onto 3405 alignment fixture (distance dimension = 10 mm).

Spacer pieces are attached to 3405 alignment fixture via a chain.

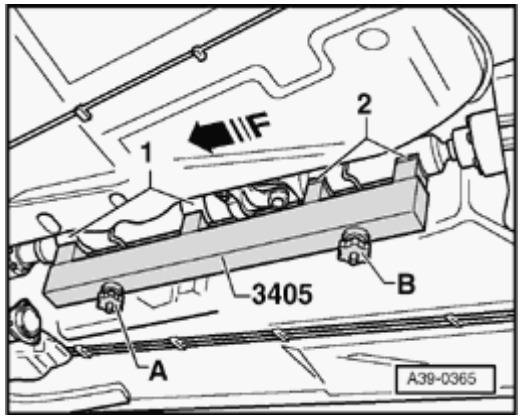
Arrow -A- points in direction of travel.

- Using spacer pieces -2-, hook in 3405 alignment fixture according to illustration.

WARNING!

Assembly tool must rest on both steel rings -1- before tightening plastic nut -A-. If that is not the case, the surface of the carbon fiber driveshaft can be damaged and must be replaced see Important notes ⇒ ***Page 39-74***

39-82

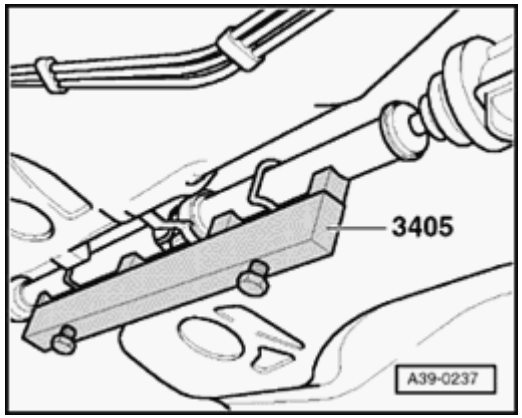


- Carefully tighten plastic nuts -A- and -B-.

Note:

Never set alignment fixture on balance plates.

For all driveshafts except for carbon fiber driveshafts:



- Attach 3405 alignment fixture and tighten plastic nuts.

Note:

Never set alignment fixture on balance plates.

For all driveshafts, also for carbon fiber driveshafts:

- Remove mounting bolts for flanges to transmission and to rear final drive as well as mounting bolts of center support.
- Push driveshaft to rear final drive together. The constant velocity joints can be adjusted axially.
- Guide driveshaft out of transmission flange using assembly tool.

Note:

Only store and move driveshaft fully extended.

39-83

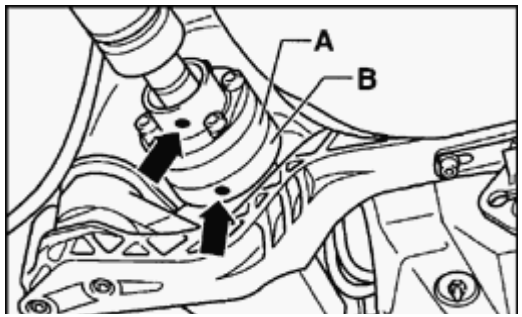
Installing

Installation is reverse of removal, noting the following:

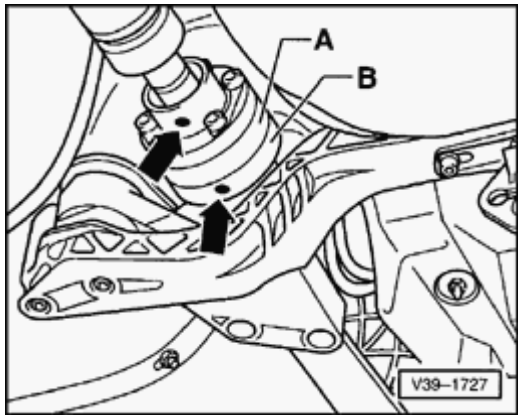
- Observe important notes ⇒ page 39-73

Notes:

- *After removing driveshaft, always remove any remaining locking fluid from thread holes in the transmission drive flanges and the rear final drive. Otherwise there is a possibility that the new bolts may get jammed when installed and shear when removed.*
- *Cleaning can be performed with a tap.*
- *Replace gaskets on drive flanges (remove protective film and attach gasket to drive flanges). Adhesive surface must be free of grease.*



- *To prevent imbalance, driveshaft flanges -A- and rear final drive flanges -B- must be installed so that the factory color markings or markings which were made afterward are aligned (arrows).*



- *If a new driveshaft is installed and the factory color marking on the rear final drive flange is no longer visible, check radial run out at flange/driveshaft ⇒ page 39-86 and adjust color marking at driveshaft to new marking at flange.*
- *After disconnecting driveshaft from rear final drive, an additional balance washer (thick washer) that may be located between shim and bolt head may not be reinstalled.*
- *Replace driveshaft bolts (self-locking).*

- Adjust driveshaft after installing ⇒ page 39-88 .
- Install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

39-85

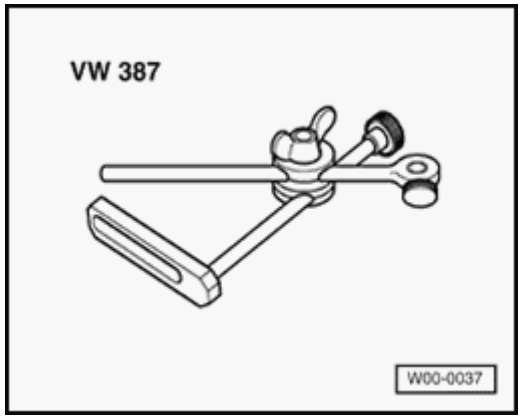
Tightening torques

Component	Nm
Driveshaft to transmission (Output flange)	55
Driveshaft to final drive (Input flange)	55
Center driveshaft support to body	23
Heat shield for driveshaft to transmission	23
Crossmember to body	25
Nuts for clamping sleeve	40

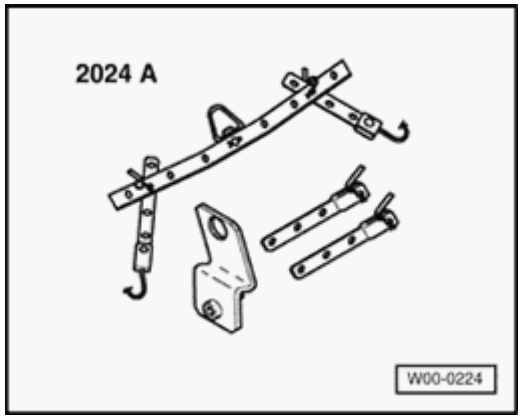
39-86

Radial play at driveshaft flange, measuring and marking

Special tools and equipment



- VW387 dial gauge holder



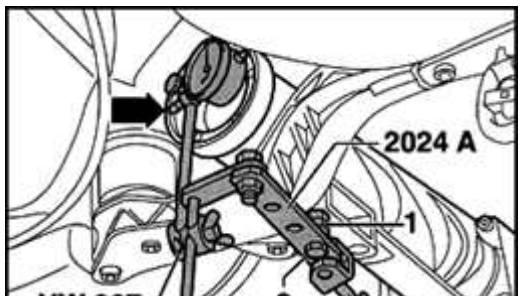
- 2024A Engine Sling
- Dial gage
- Bolt M10 x 85

39-87

Notes:

- *Always measure radial run-out if torque tube has been removed. Make new color marking and remove old color marking.*
- *If a new driveshaft is installed and the color marking on the drive flange of the rear final drive is no longer visible, location of largest radial run-out must be determined and marked with a color marking.*
- *Align this colored dot with colored dot on driveshaft* ⇒ *page 39-83* .
- *Radial run-out can also be measured with the rear final drive installed, for this the driveshaft must be disconnected from the rear final drive. Observe notes* ⇒ *page 39-73* .

- Remove left front bolt at transmission mount for rear final drive.



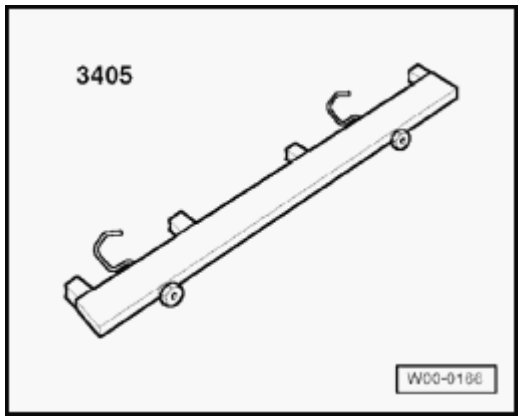
- Remove strap from 2024A engine sling and tighten at empty hole using an M10 x 85 mm -2- bolt. Place 5 M12 nuts -1- under strap.
- Bolt VW387 dial gauge holder to strap in this position.
- Set dial indicator onto ground diameter (arrow) in driveshaft flange and set to "0" with 1 mm preload.

- Turn differential gear via both rear wheels (left and right flanges) at the same time in one direction until drive flange/driveshaft flange has made on complete revolution.
- Mark largest radial run-out on outer edge of flange with colored marking (equivalent to largest distance from turning axis).
- Remove old marking on driveshaft flange.
- Installing driveshaft ⇒ page 39-83 .

39-88

Driveshaft, adjusting

Special tools and equipment



♦ 3405 alignment fixture

- Observe notes ⇒ page 39-73 .

Adjustments must be made very carefully as a poorly adjusted driveshaft is usually the cause of vibrations and humming noises.

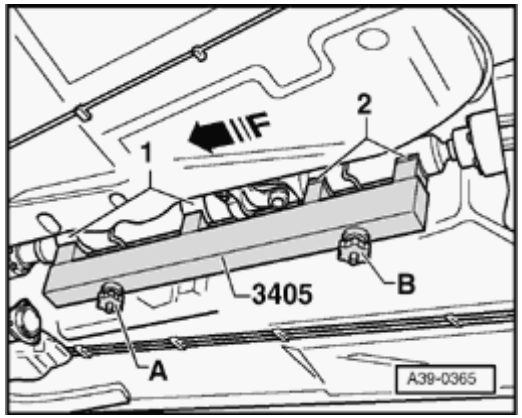
- Remove crossmember below exhaust system if installed.
- Remove rear part of exhaust system starting at clamp to gain access to the driveshaft:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Remove heat shields above driveshaft.
- Release mounting bolts for center support slightly.

39-89

Only for carbon fiber driveshafts:



- Place spacer pieces -2- onto 3405 alignment fixture (distance dimension = 10 mm).

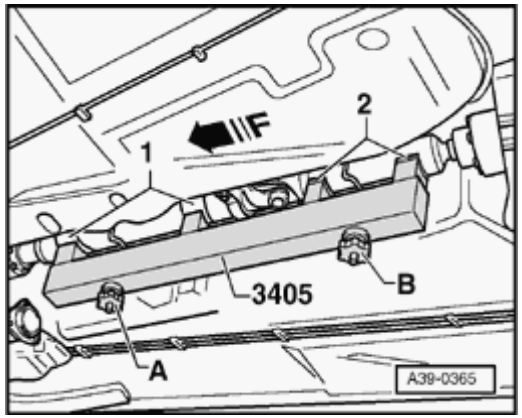
Spacer pieces are attached to 3405 alignment fixture via a chain.

Arrow -A- points in direction of travel.

- Using spacer pieces -2-, hook in 3405 alignment fixture according to illustration.

WARNING!

Assembly tool must rest on both steel rings -1- before tightening plastic nut -A-. If that is not the case, the surface of the carbon fiber driveshaft can be damaged and must be replaced see Important notes ⇒ ***page 39-74***



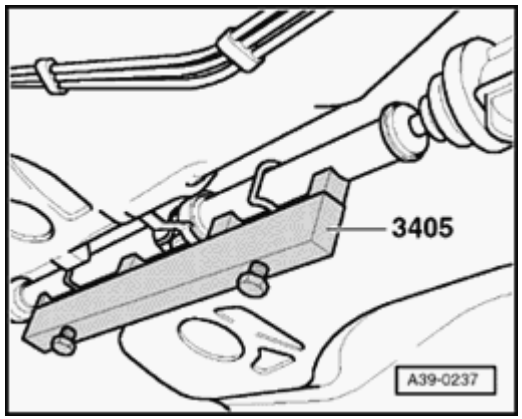
- Carefully tighten plastic nuts -A- and -B-.

Note:

Never set alignment fixture on balance plates.

39-90

For all driveshafts except for carbon fiber driveshafts:



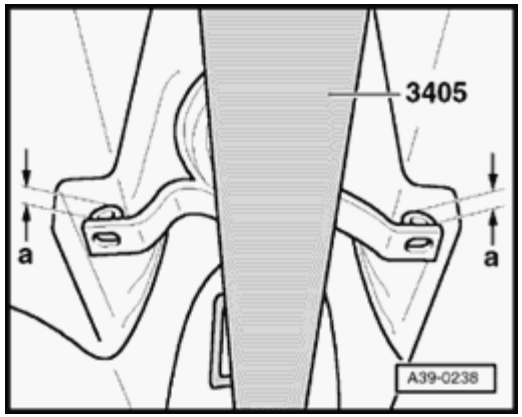
- Attach 3405 alignment fixture and tighten plastic nuts.

Note:

Never set alignment fixture on balance plates.

For all driveshafts, also for carbon fiber driveshafts:

- Remove center support mounting bolts and adjustment shims.



- Align driveshaft center support so that distance -a- (left side) is equal to distance -a- (right side).
- Measure distances -a-.
- Determine adjustment shims according to table. Part numbers

⇒ *Parts-catalog*

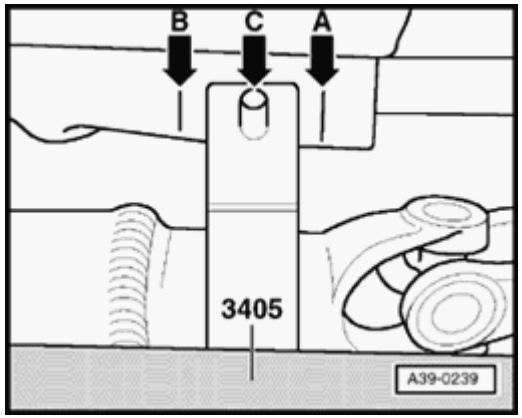
39-91

Available adjustment shims

Distance -a- (mm)	Shim thickness (mm)
0 to 3.0	-
3.1 to 5.0	2
5.1 to 7.0	4
7.1 to 9.0	6
9.1 to 11.0	8
11.1 to 13.0	10

- Install left and right shims determined from table.

39-92



Centering driveshaft lengthwise

- Slide driveshaft with alignment fixture toward rear to stop.
- Mark position of center support on body (arrow A).
- Slide driveshaft with alignment fixture toward front to stop.
- Mark position of center support on body -(arrow B).
- Center driveshaft (arrow C):
  - ♦ Center support must be centered between markings -A- and -B-.
- Install mounting bolts for driveshaft center support and the pre-determined shims and tighten.
- Remove alignment fixture.
- Install heat shield above driveshaft.

39-93

Installation is reverse of removal, noting the following:

- Install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

Tightening torques

Component	Nm
Center driveshaft support to body	23
Crossmember to body	25
Nuts for clamping sleeve	40

Drive flange/driveshaft radial deviation, measuring and identifying

Special tools and equipment

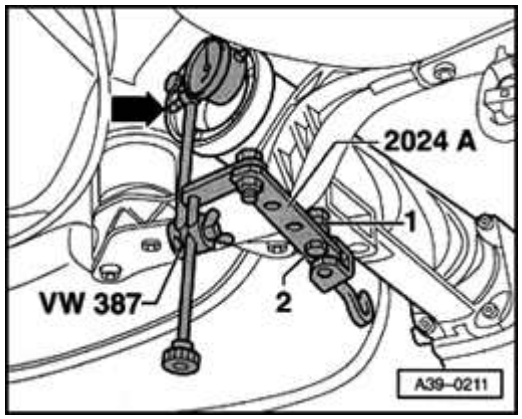
- VW38 universal measurement bracket
- 2024A engine sling
- Dial indicator
- Bolt M10 x 85

Notes:

- *Radial deviation must always be measured, when the torque tube is removed. Apply a new color marking and remove the old one.*
- *If a new driveshaft is installed and the color marking on the drive flange of the final drive is no longer visible, the location of the largest radial deviation must be determined and identified with a color marking.*
- *This color marking is then matched with the color marking on the driveshaft* ⇒ *Page 39-74* .

- *The radial deviation can also be measured with final drive installed, by separating driveshaft at final drive. Notes ⇒ Page 39-68 .*

- Remove front left bolt at crossmember for final drive.



- Remove strap from 2024A engine sling and tighten with bolt -2- (M10 x 85 mm) at open bore. Position strap using approx. 5 nuts (M12) for backing -1-.
- Secure VW387 dial gauge holder onto strap mounted in this position.
- Place dial indicator on inside machined surface of drive flange (arrow) and set to "0" with with 1 mm preload.
- Turn differential simultaneously in one direction by turning rear wheels (drive flanges right and left), until drive flange makes complete rotation.
- Identify greatest radial deviation on outer drive flange with color marking (corresponds to largest dimension from pivot axis).
- Remove old color marking on drive flange.
- Install driveshaft ⇒ Page 39-74 .

Driveshaft, adjusting

Special tools and equipment

- 3298 alignment fixture for all wheel drive driveshaft
- 3139/2 spacer

- Observe all cautions ⇒ Page 39-68

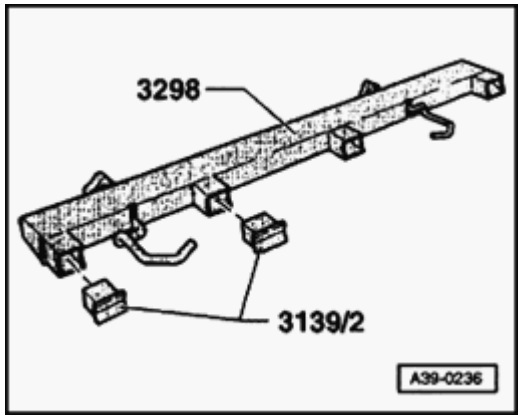
Adjustments should be carried out carefully, because a badly adjusted driveshaft is often the cause of vibration and droning noises.

- Remove crossmember below exhaust system, if installed.

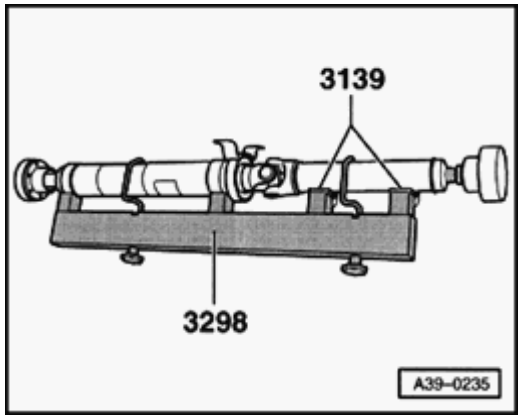
- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

39-80



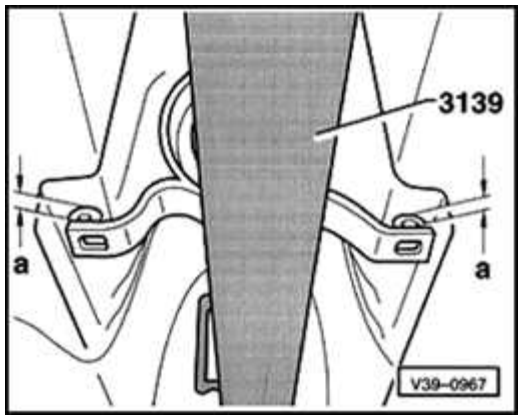
- Place two 3139/2 spacers in 3298 assembly tool.



- Mount 3298 assembly tool with two 3139/2 spacers and tighten plastic nuts.

Note:

Never install alignment fixture onto balance plates.



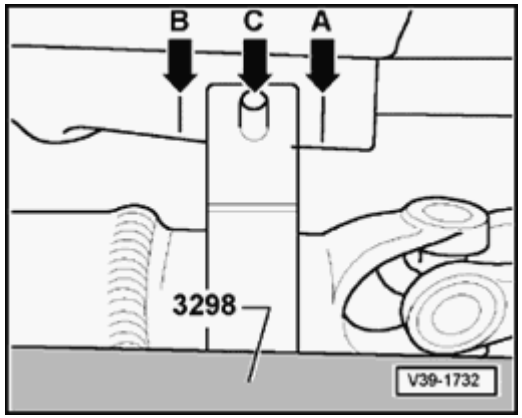
- Remove mounting bolts and shims of center bearing.

- Align center driveshaft bearing so that dimensions -a- are same on both sides.
- Measure dimensions -a-.
- Identify shims according to table. Part numbers ⇒ parts catalog

The following shims are available

Dimension -a- (mm)	Shim thickness (mm)
0-3.0	-
3.1-5.0	2
5.1-7.0	4
7.1-9.0	6
9.1-11.0	8
11.1-13.0	10

- Install selected shims on both sides.



Aligning driveshaft longitudinally

- Push driveshaft with alignment fixture toward rear as far as possible.
- Mark position of center bearing on body (arrow -A-).
- Push driveshaft with alignment fixture toward front as far as possible.
- Mark position of center bearing on body (arrow -B-).
- Align driveshaft (arrow -C-).

The center bearing must be aligned centrally between markings -A- and -B-.

- Install mounting bolts for center driveshaft bearing together with previously selected shims, and tighten.
- Remove alignment fixture.
- Install heat shield above driveshaft.

Installation is the reverse of removal, note the following:

- Align exhaust system free of stress.

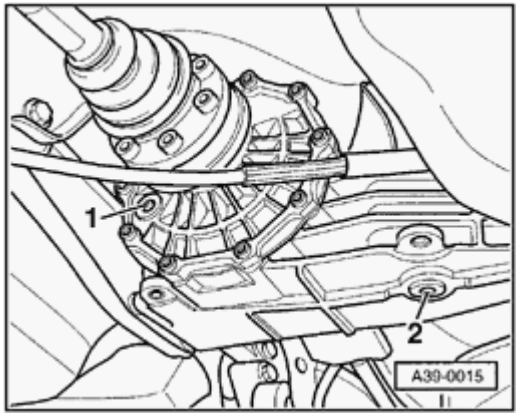
⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

Component		Tightening torque
Center bearing to body		23 Nm (17 ft lb)
Front cross-member below exhaust system to body		25 Nm (18 ft lb)
Nuts on exhaust pipe clamp		40 Nm (30 ft lb)

39-80

Oil level in rear final drive, checking



- Remove oil filler plug -1- to check final drive oil level.

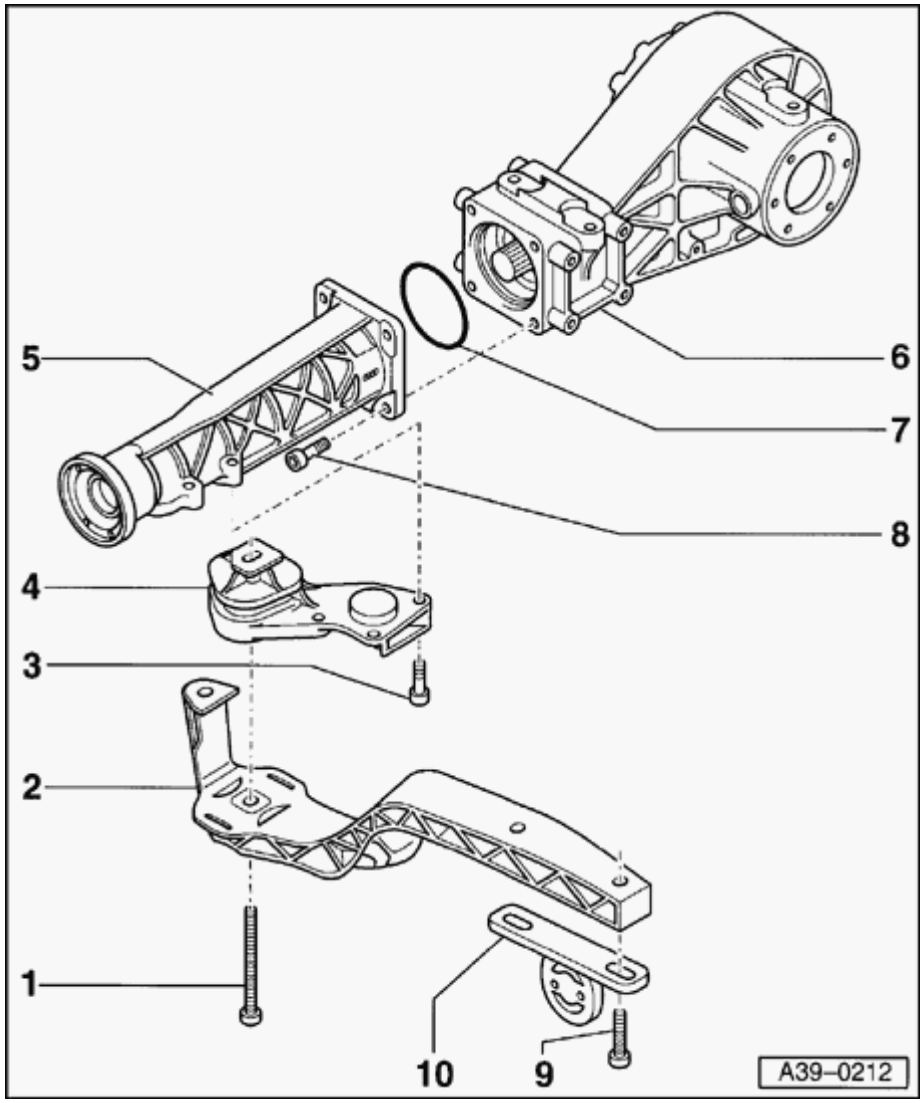
  Specification: oil level up to lower edge of filler hole.
- Top-up gear oil if necessary.

  Specification ⇒ Page 00-6 .
- Fit oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	35

39-81



Drive flange housing, removing and installing

Assembly overview

1 - Bolt, 40 Nm

2 - Front cross member

3 - Bolt, 40 Nm

4 - Final drive support

5 - Drive flange housing

6 - Rear final drive housing

7 - O-ring

8 - Bolt, 35 Nm

9 - Bolt, 23 Nm

10 - Bracket

- For exhaust system

39-82

Removing

- Rear final drive installed

Special tools, testers and auxiliary items

- Multipurpose tool VW 771 and 771/15
- Drip tray V.A.G 1306
- Universal support V.A.G 1359/2
- Engine/transmission jack V.A.G 1383 A

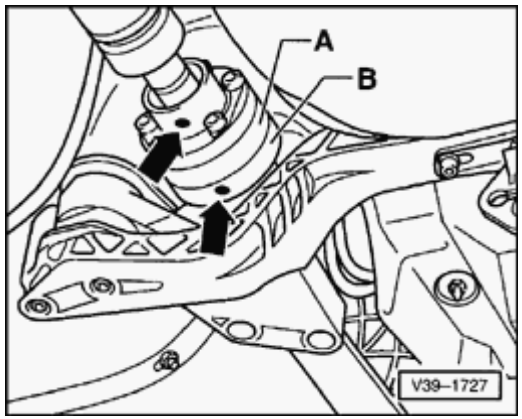
- Place drip tray V.A.G 1306 underneath and drain transmission oil.

- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

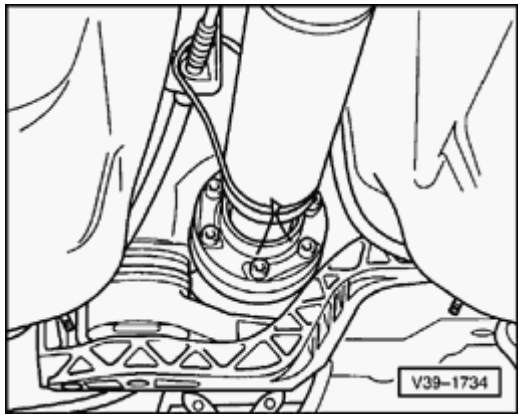
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Remove heat shield above driveshaft.

- Remove heat shield next to rear final drive.



- Check whether there is a factory marking (paint spot) on driveshaft. If not, mark position of driveshaft flange -A- in relation to rear final drive (arrow -B-) with paint.
- Unscrew bolts from driveshaft flange.

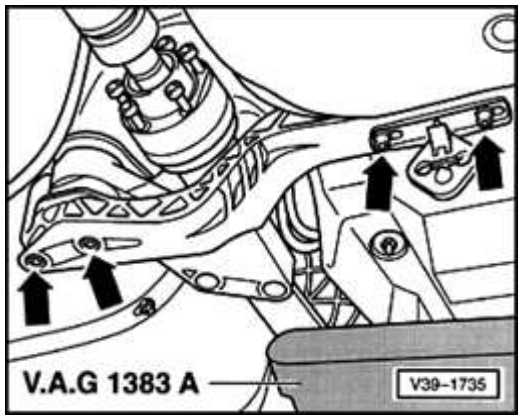


- Secure driveshaft to parking brake cable bracket with wire.

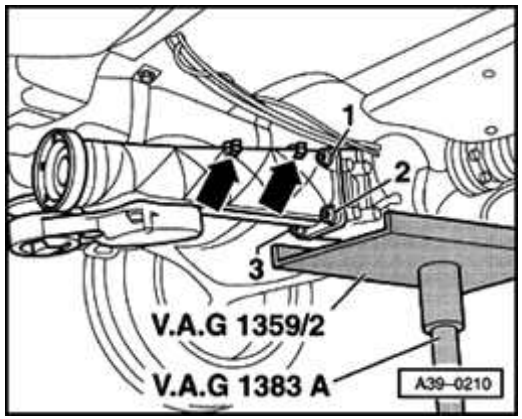
Note:

If it is not possible to push the driveshaft up and off the flange, lower the final drive before tying up the driveshaft. When lowering the final drive, prevent the driveshaft from dropping down, and do not bend the center joint further than the maximum angle permitted ⇒ Page 39-64 , Notes.

- Support final drive with transmission jack V.A.G 1383 A.



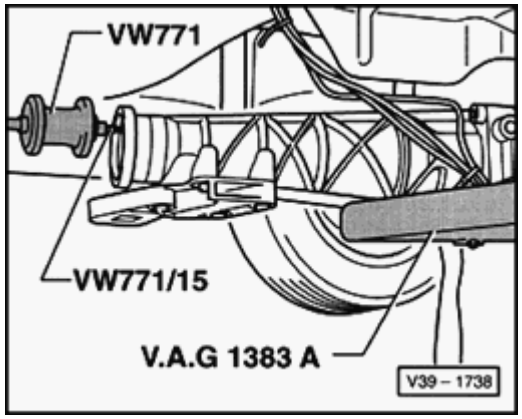
- Unscrew bolts (arrows) on front cross member for rear final drive.
- Detach front cross member.
- Lower final drive about 10 cm.



- Unscrew 4 bolts for drive flange housing (see -1-, -2- and -3- in illustration).

Note:

Fourth bolt not shown in illustration.



- Pull off drive flange with drive flange housing.

Installing

Installation is carried out in the reverse order; when doing this note the following:

Note:

- *After removing the driveshaft, it is important to clean any remaining locking compound out of the threads in the drive flanges on the transmission and rear final drive. If this is neglected, the new bolts can seize when they are screwed in and shear off later if they have to be removed.*
- *The threaded holes can be cleaned with a thread tap.*
- *Replace gasket between driveshaft and drive flange (pull off backing foil and stick gasket onto drive flange). Surface must be free of grease.*
- *Replace driveshaft bolts (self-locking).*

- If there is a factory marking on the driveshaft, measure the radial run-out at the flange for the driveshaft (⇒ Page 39-73) and align the paint marking on the driveshaft with new marking on the flange.

- Align exhaust system free of stress.

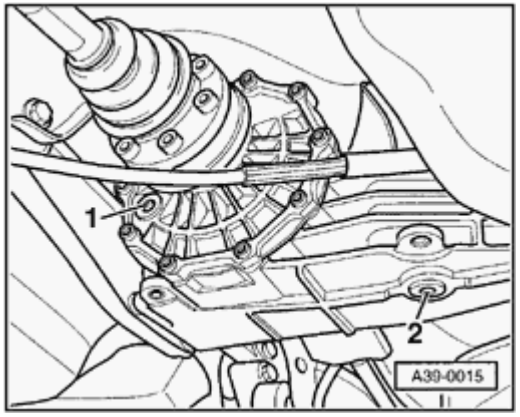
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Top up gear oil in rear final drive and check oil level ⇒ Page 39-80 .

Tightening torques

Component	Nm
Drive flange housing to rear final drive	35
Driveshaft to final drive (input flange)	55
Front cross member for rear final drive to body	40
Front cross member for rear final drive and exhaust bracket to body	23
Oil filler plug	35
Nuts for clamp	40

Oil level in rear final drive, checking



- Remove oil filler plug -1- (arrow) to check oil

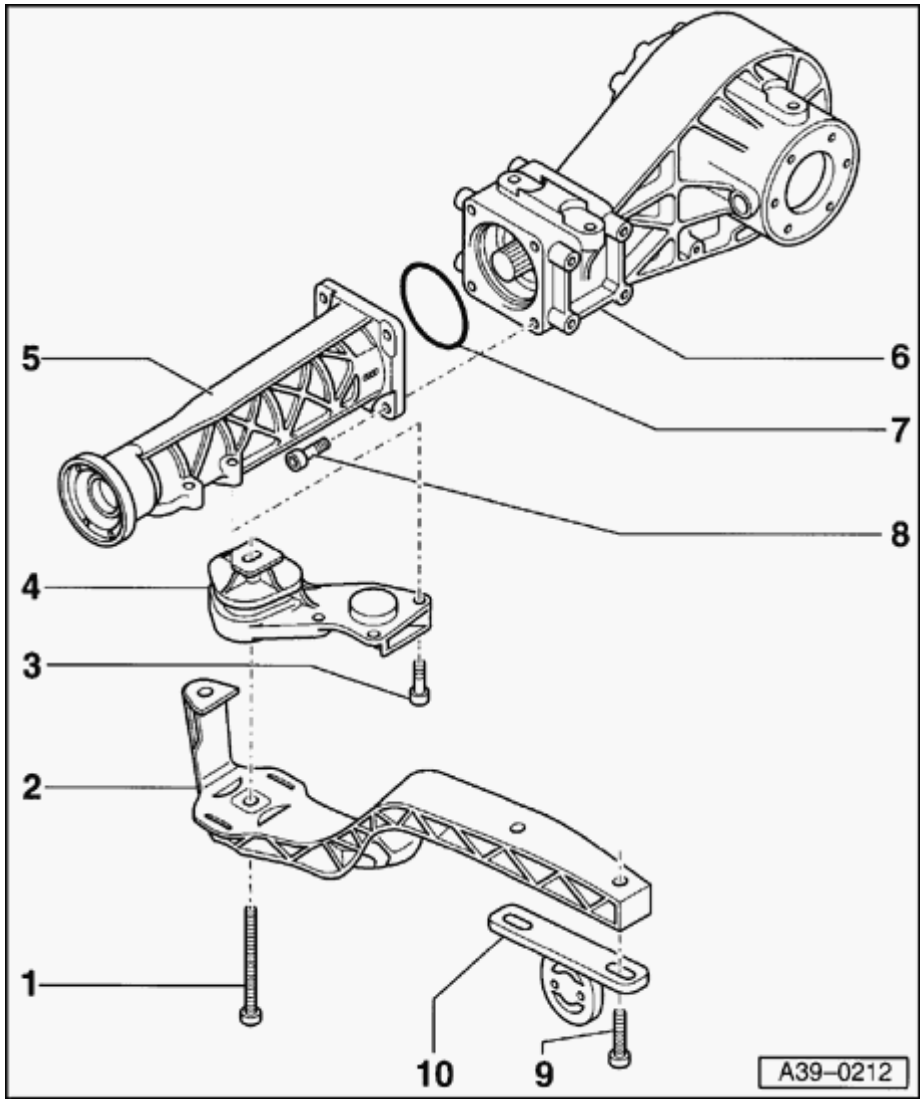
Specification: oil level up to lower edge of filler hole

- Top off gear oil if necessary, specification ⇒ Page 00-9 .
- Install oil filler plug.

Tightening torque

Component	Tightening torque
Oil filler plug	35 (26 ft lb)

39-85



Drive flange housing, removing and installing

Assembly overview

1 - Bolt

- 40 Nm (30 ft lb)

2 - Front crossmember

3 - Bolt

- 40 Nm (30 ft lb)

4 - Transmission support

5 - Drive flange housing

6 - Final drive housing

7 - O-ring

8 - Bolt

- 35 Nm (26 ft lb)

9 - Bolt

- 23 Nm (17 ft lb)

10 - Mounting bracket

- For exhaust system

39-86

Removing

- Rear differential installed

Special tools and equipment

- VW771 with 771/15 multi-purpose tool
- VAG1306 drip tray
- VAG1359/2 universal mounting
- VAG1383A engine-/transmission hoist

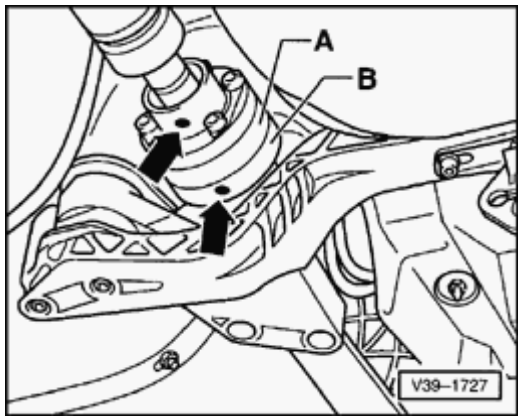
- Place VAG1306 drip tray underneath transmission and drain fluid.

- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

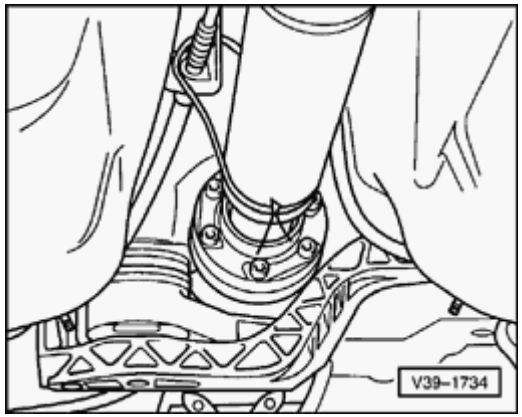
⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Remove heat shield above driveshaft.

- Remove heat shield next to rear differential.



- Check for factory color marking on driveshaft. If not, mark position of driveshaft flange -A- to drive flange in rear differential -B- with color marking.
- Remove mounting bolts from driveshaft flange.



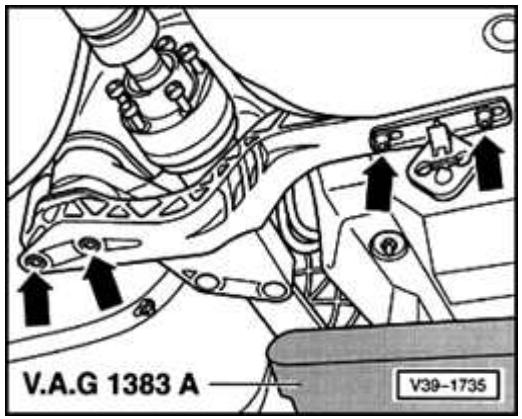
- Tie driveshaft to mount for parking brake cable using wire.

Note:

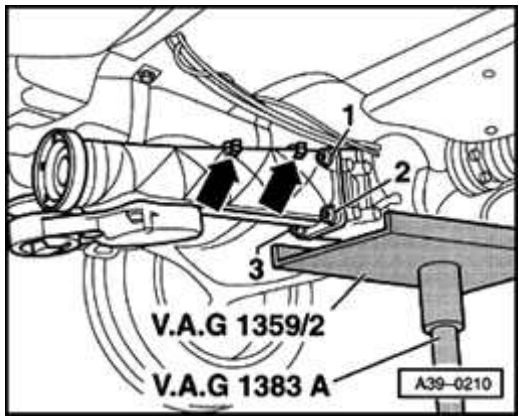
If driveshaft cannot be pushed upward past flange, tie up driveshaft after lowering the differential. When lowering driveshaft, protect it from dropping and note the permissible bend angle of driveshaft ⇒ Notes, ⇒ *Page 39-68* *.*

39-88

- Support final drive using VAG1383A.



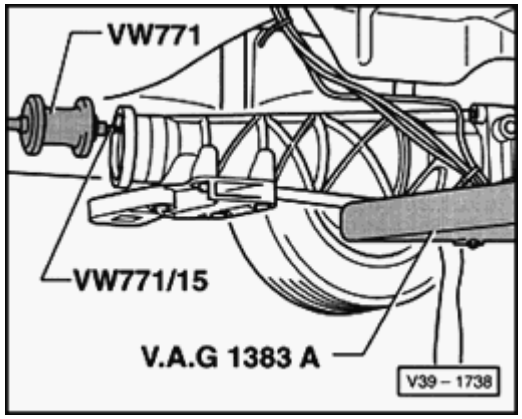
- Remove bolts (arrows) from front crossmember for final drive.
- Remove crossmember front.
- Lower final drive approx. 10 cm (4 in.).



- Remove 4 bolts for drive flange housing -1-, -2- and -3-.

Note:

The 4th bolt is not visible in the illustration.



- Pull off drive flange together with housing.

Installing

Installation is the reverse of removal, note the following:

Notes:

- *The threaded bores in the drive flanges of the transmission and the final drive should be cleaned of all locking compound residue after driveshaft has been removed. Otherwise there is a risk of seizing the bolt when tightening and break off at next disassembly.*
- *Clean by using a thread tap.*
- *Replace seals between driveshaft and drive flange (Remove protective film and bond seal to drive flange. Adhesive bond surface must be free of grease.*
- Always replace self-locking driveshaft bolts.

- If driveshaft has factory color marking, determine radial deviation on flange/driveshaft ⇒ Page 39-77 and align color marking on driveshaft to new color marking on drive flange.

- Align exhaust system free of stress.

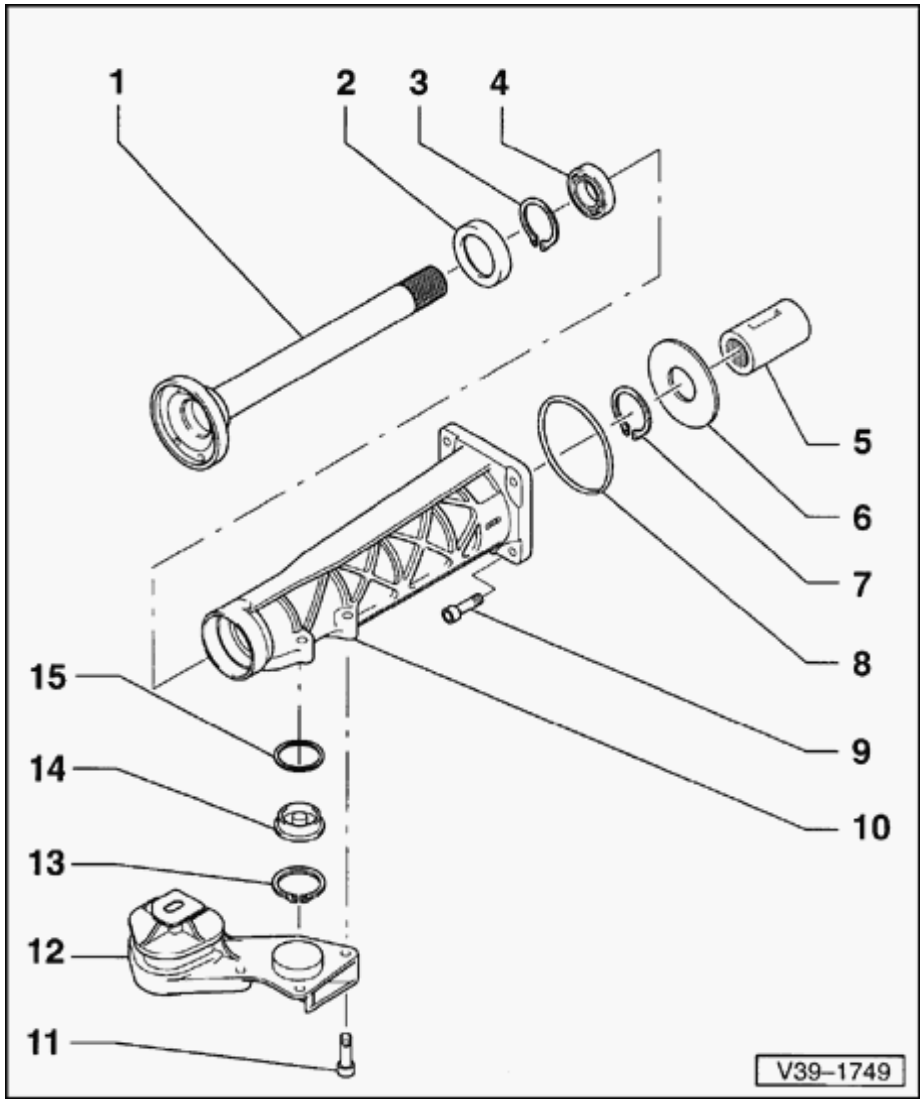
⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Top off transmission oil for final drive and check oil level ⇒ Page 39-84 .

Tightening torques

Component	Tightening torque
Drive flange housing to final drive	35 Nm (26 ft lb)
Driveshaft to final drive	55 Nm (41 ft lb)
Front crossmember for final drive to body	40 Nm (30 ft lb)
Front crossmember for final drive with mounting bracket for exhaust system to body	23 Nm (17 ft lb)
Oil filler plug	35 Nm (26 ft lb)
Nuts for clamping sleeve	40 Nm (30 ft lb)

39-91



Drive flange housing

Note:

Drive flange housing, removing and installing ⇒ *Page 39-85* .

1 - Drive flange

- Disassembling ⇒ Page 39-94
- When installing, circlip item -7- must be simultaneously installed through hole in housing ⇒ Page 39-99

2 - Seal

- Prying out ⇒ Page 39-96
- Driving in ⇒ Page 39-98

3 - Circlip

- Removing ⇒ Page 39-96

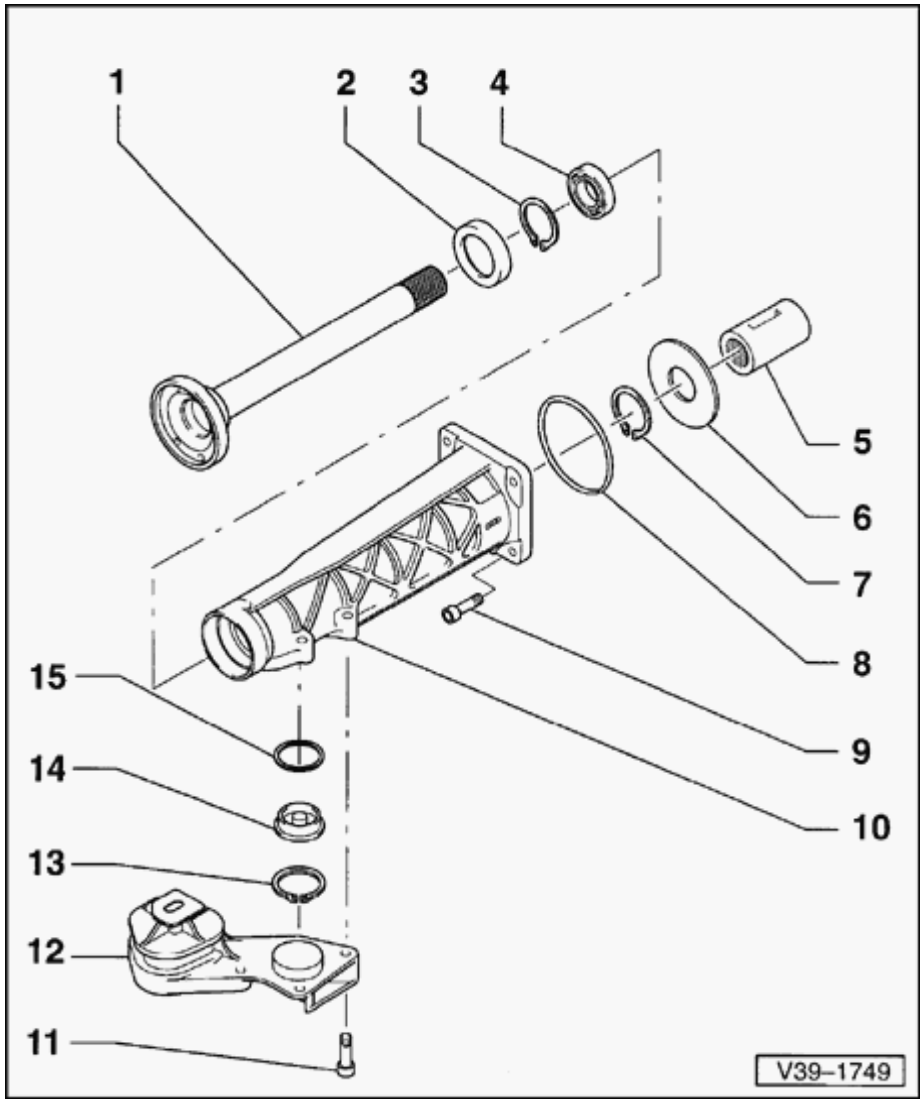
4 - Grooved ball bearing for drive flange

- Removing ⇒ Page 39-97
- Assembling ⇒ Page 39-98

5 - Sleeve

- Removing ⇒ Page 39-94
- Pressing on ⇒ Page 39-99

39-92



6 - Washer

- Press out only if damaged
- Installing ⇒ Page 39-97

7 - Circlip

- Expand to remove drive flange ⇒ Page 39-95

8 - O-ring

- Always replace

9 - Bolt

- 35 Nm (26 ft lb)
- For mounting drive flange housing to final drive housing

10 - Drive flange housing

11 - Bolt

- 40 Nm (30 ft lb)
- For fastening transmission support to drive flange housing

12 - Transmission support

13 - Circlip

- Removing ⇒ Page 39-94

14 - Cap

- Removing ⇒ Page 39-94

15 - O-ring

- Always replace

39-93

Drive flange housing, disassembling and assembling

Special tools and equipment

- VW402 thrust plate
- VW409 punch
- VW412 thrust disc
- VW433 thrust pad
- VW771 slide hammer-complete set with VW771/15 threaded piece
- 2051 arbor
- 2062 driver
- 2078 tappet tensioner
- Kukko 21/5 extractor

Note:

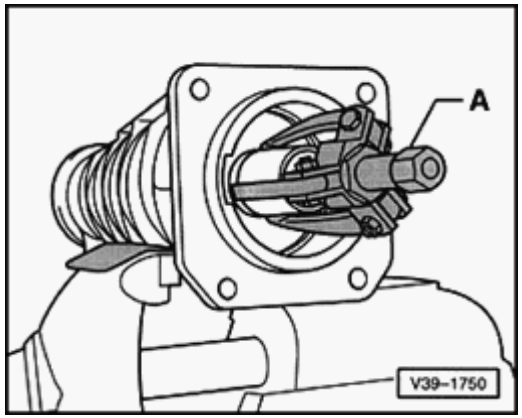
Drive flange housing removing and installing ⇒

Page 39-85

39-94

Disassembling

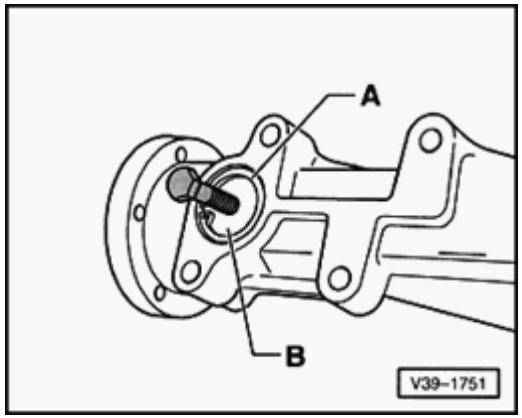
- Clamp drive flange housing in vise using protective jaws.



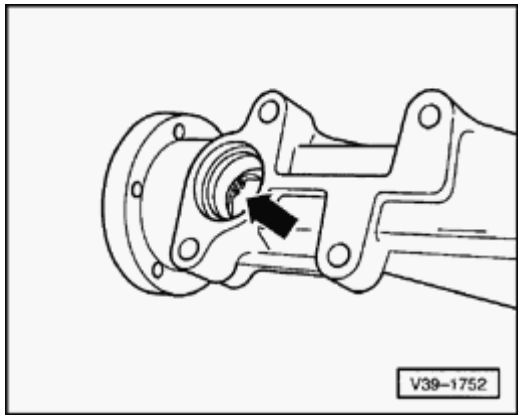
- Remove sleeve.

A- puller 30-37 mm, e.g. Kukko 21/5 extractor

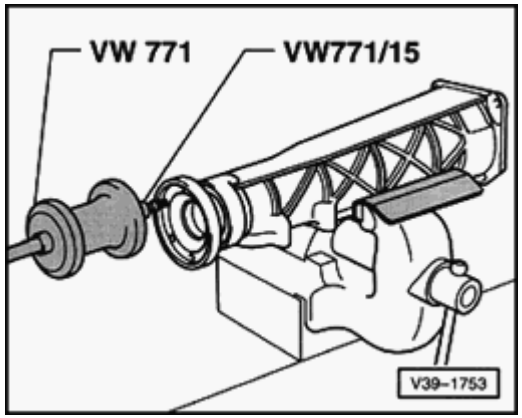
- Remove transmission support.



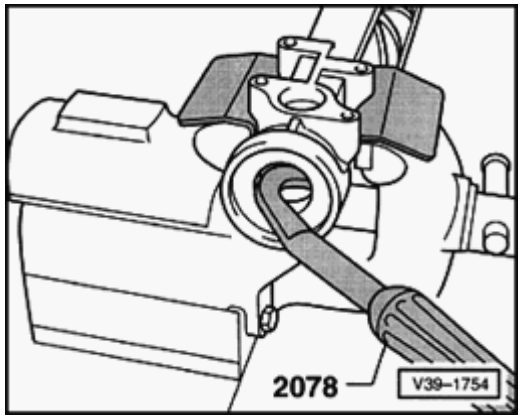
- Remove circlip -A-.
- Screw M8 bolt into thread bore of cap -B- and remove cap.



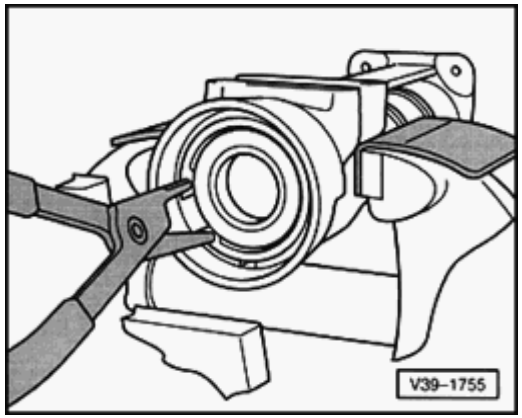
- Expand circlip (arrow) on drive flange and slide in direction of notched splining.



- Remove drive flange.
- Remove circlip from drive flange housing.

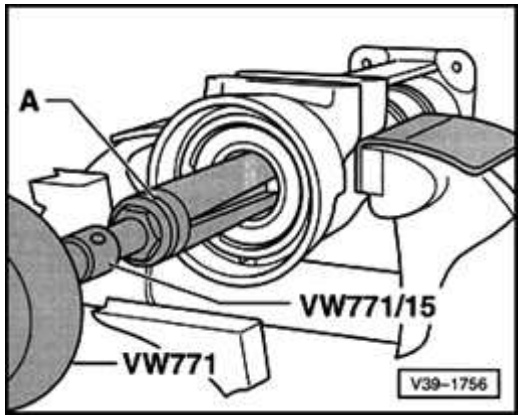


- Pry out seal.



- Remove circlip.

39-97



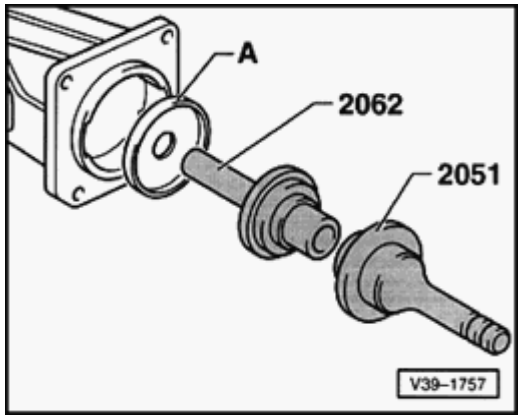
- Remove grooved ball bearing from drive flange.

A- Puller 30-37 mm, e.g. Kukko 21/5 extractor

Note:

The bearing is damaged when removed.

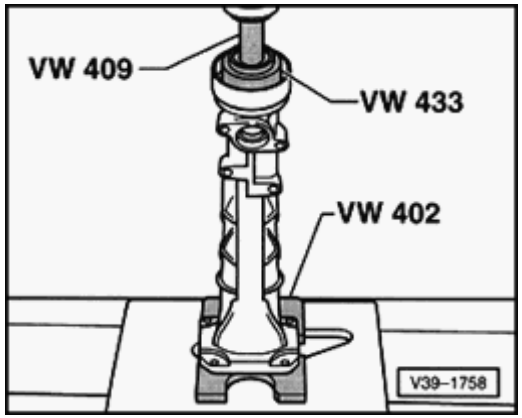
Only if washer is damaged



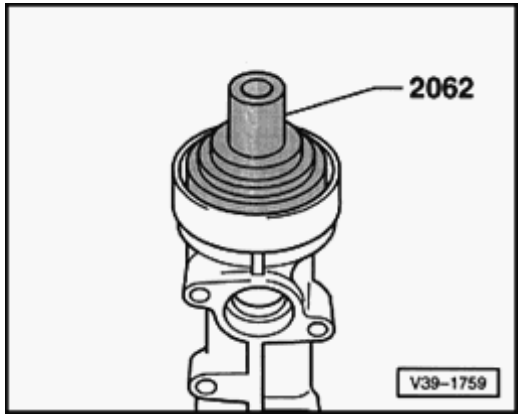
- Push out damaged washer with drive flange.
- Install washer -A- until stop is reached.

39-98

Assembly

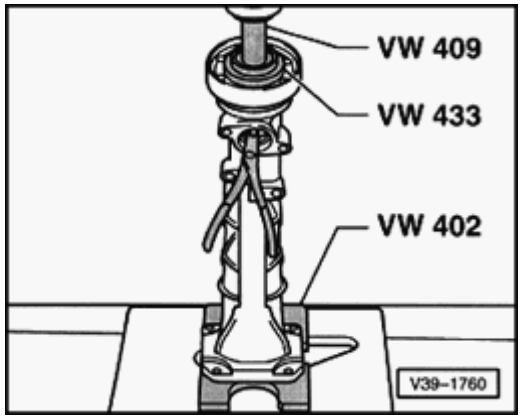


- Press grooved ball bearing into drive flange housing.
- Insert circlip outside.

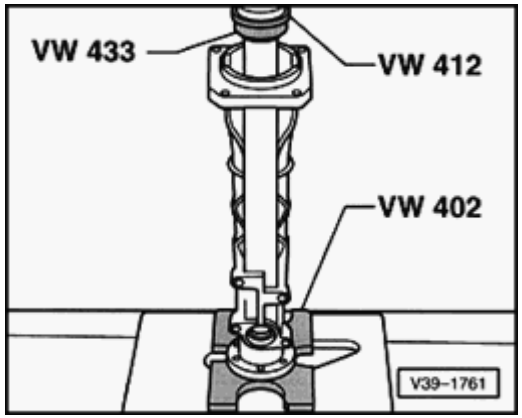


- Fill seal between sealing lip and dust lip with gear oil.
- Drive in O-ring until stop is reached.

39-99



- Insert circlip into drive flange housing and hold with pliers.
- Press in drive flange.
- Insert circlip in groove.



- Press sleeve onto drive flange until stop is reached.
- Install cap with O-ring.
- Install circlip.
- Install transmission support.
- Place O-ring on drive flange housing.

39-100

Drive flange seals, replacing

- Final drive installed

- Refer to general repair instructions ⇒ Page 00-14 .

Note:

The exhaust system needs to be removed only if the left seal is replaced.

Special tools and equipment

- 2062 driver
- 3066 seal installer set
- VAG1306 drip tray
- VAG1359/2 universal mount
- VAG1383A engine/transmission hoist

39-101

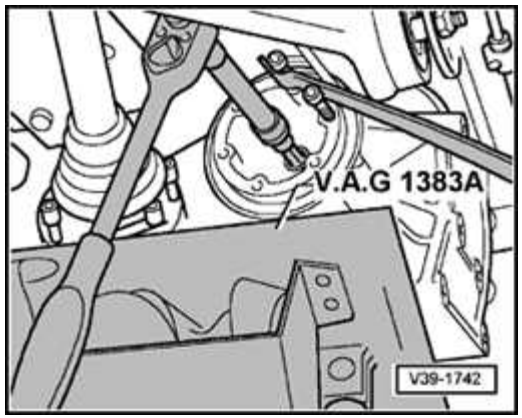
Removing

- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

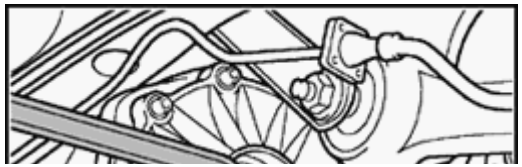
⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Unbolt driveaxles on left and right from rear final drive and place to side.

⇒ *Repair Manual, Suspension, Wheels, Brakes, Steering, Repair Group 42*



- To loosen mounting bolts, screw two bolts into drive flange and counterhold using pry bar.
- Place VAG1306 drip tray underneath and drain oil.
- Remove drive flange using screwed in bolts.

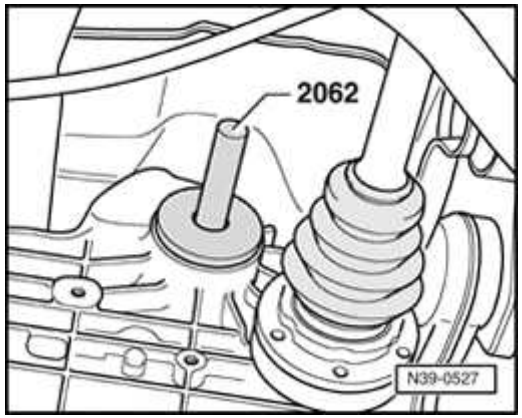


- Pry out drive flange seal using pry bar.

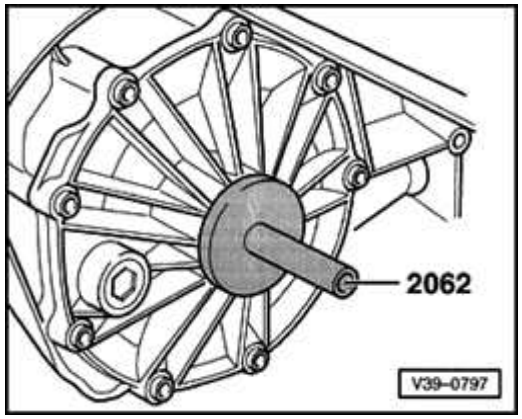
Installing

Installation is the reverse of removal, note the following:

- Clean seat for O-ring.
- Lightly oil outer circumference of seal.
- Fill space between sealing lip and dust lip with gear oil.



- Install seal for left drive flange using 2062 driver until stop is reached, without canting seal.



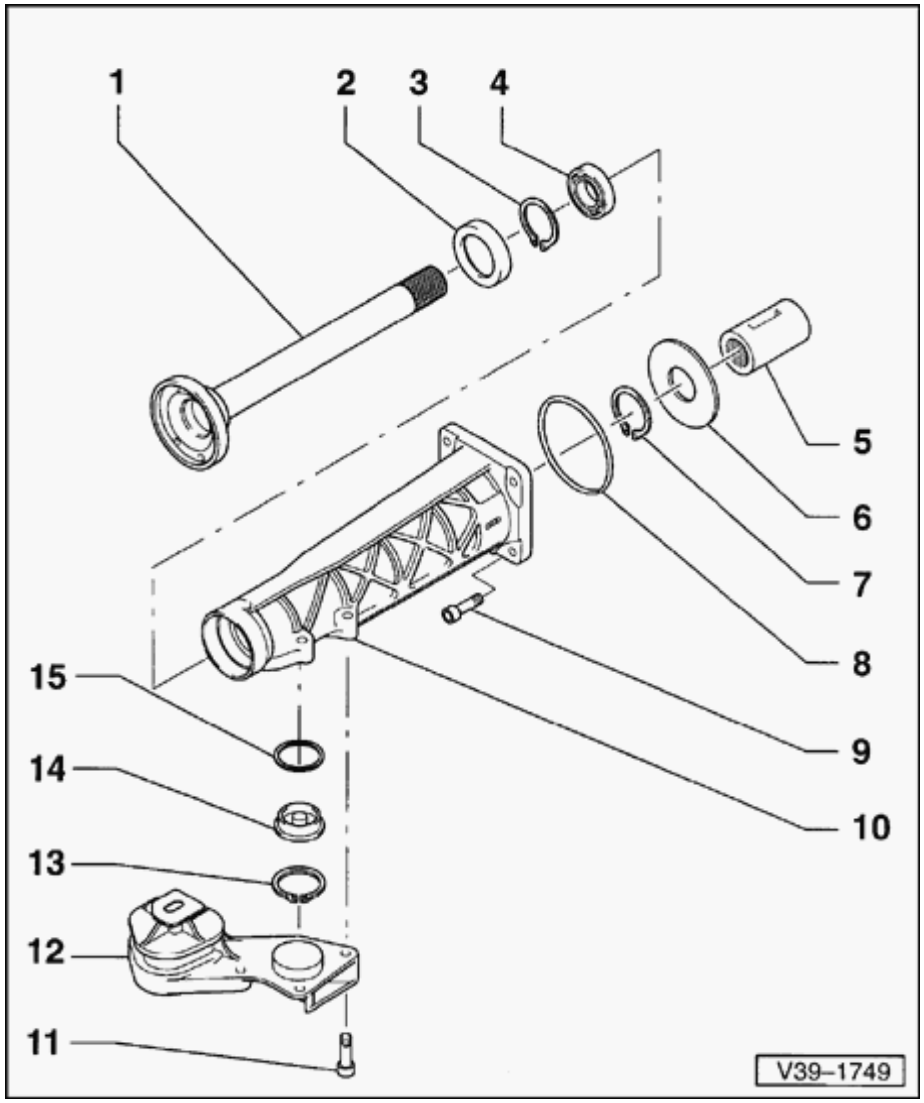
- Install seal for right drive flange using 2062 driver until stop is reached, without canting seal.
- Bolt on driveshaft.
- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Top off gear oil in final drive and check oil level ⇒ Page 39-84 .

Tightening torques

Component	Tightening torque
Drive flange to final drive	25 Nm (18 ft lb)



Drive flange housing, disassembling and assembling

Assembly overview

Note:

Removing and installing drive flange housing ⇒ *Page 39-81* .

1 - Drive flange

- Removing ⇒ Page 39-93
- When installing drive flange, circlip - 7 - should be inserted at the same time through hole in housing ⇒ Page 39-97

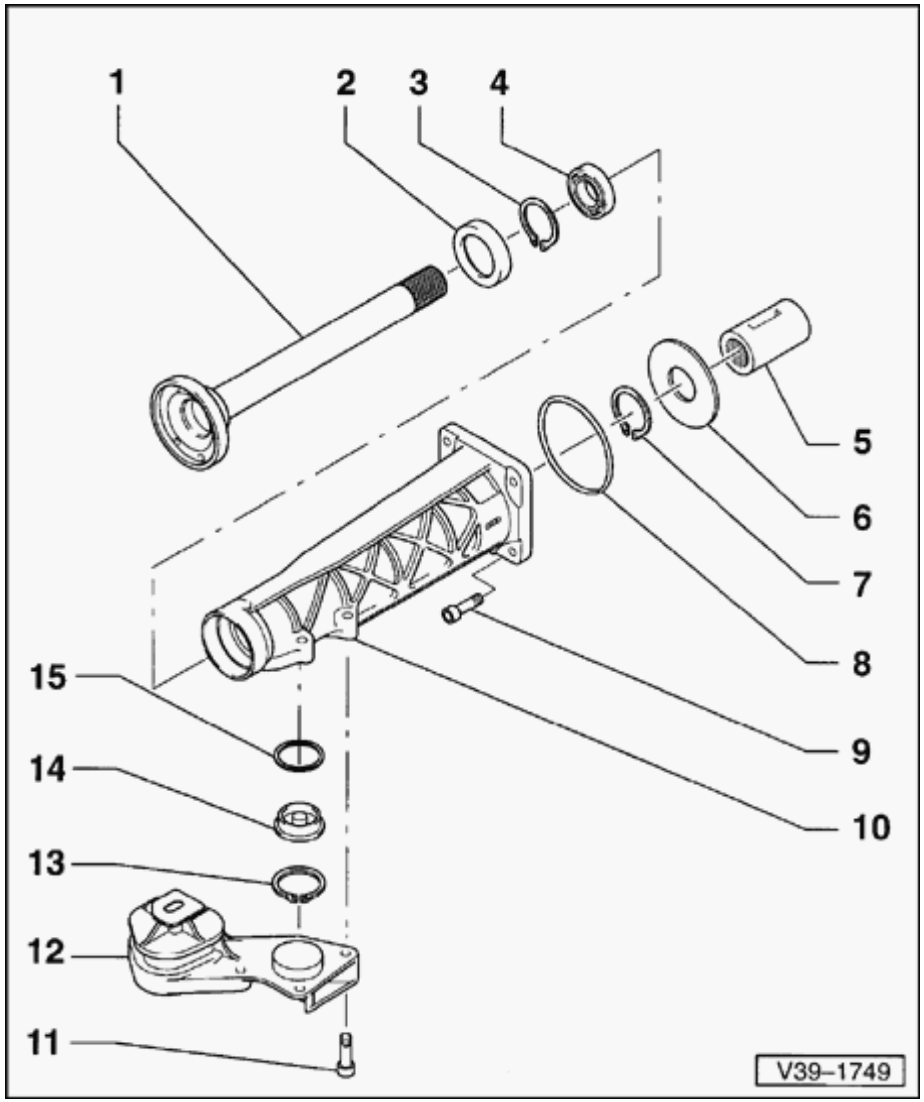
2 - Seal

- Prising off ⇒ Page 39-94
- Driving in ⇒ Page 39-96

3 - Circlip

- Removing ⇒ Page 39-94

39-89



4 - Grooved ball bearing for drive flange

- Pulling out ⇒ Page 39-95
- Pressing in ⇒ Page 39-96

5 - Sleeve

- Pulling off ⇒ Page 39-92
- Pressing on ⇒ Page 39-97

6 - Baffle plate

- Only press out if damaged
- Installing ⇒ Page 39-95

7 - Circlip

- To remove drive flange, open out circlip ⇒ Page 39-93

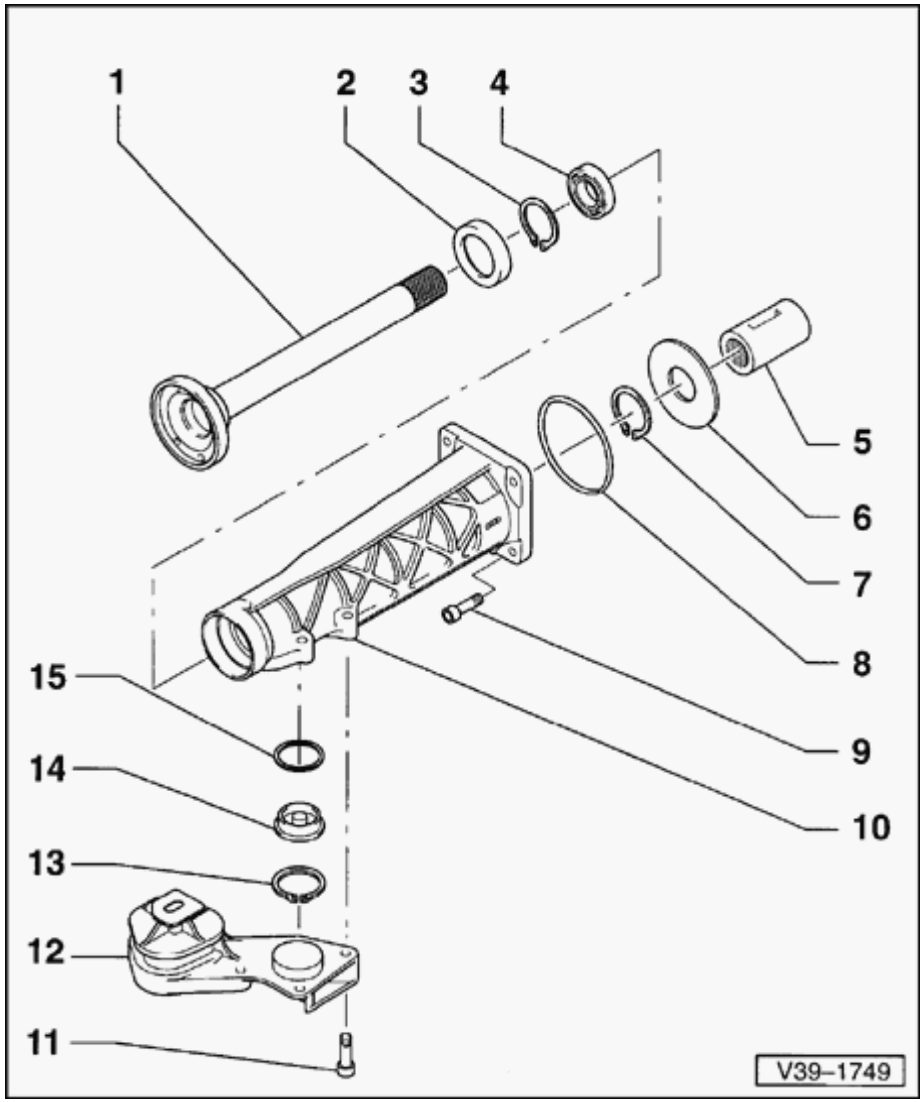
8 - O-ring

- Always replace

9 - Bolt, 35 Nm

- Secures drive flange housing to rear final drive housing

39-90



10 - Drive flange housing

11 - Bolt, 40 Nm

- Secures final drive support to drive flange housing

12 - Final drive support

13 - Circlip

- Removing ⇒ Page 39-92

14 - Cover cap

- Removing ⇒ Page 39-92

15 - O-ring

- Always replace

39-91

Drive flange housing, disassembling and assembling

Special tools, testers and auxiliary items

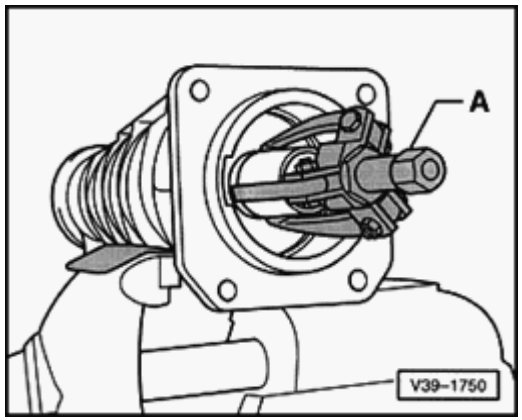
- Press plate VW 402
- Press tool VW 409
- Press tool VW 412
- Press tool VW 433
- Multipurpose tool VW 771 and 771/15
- Mandrel 2051
- Drift 2062
- Tappet compressor 2078
- Internal puller Kukko 21/5

Note:

Removing and installing drive flange housing ⇒ *Page 39-81* .

Disassembling

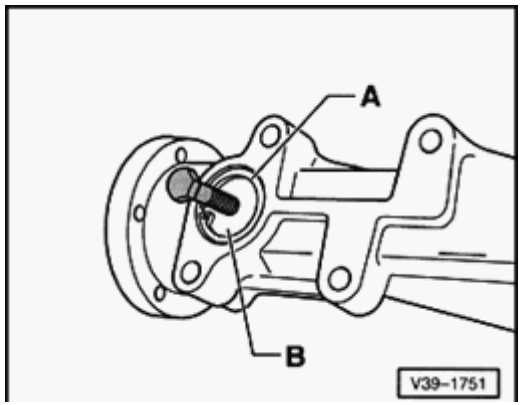
- Clamp drive flange housing in vice (use soft jaws).



- Pull off sleeve.

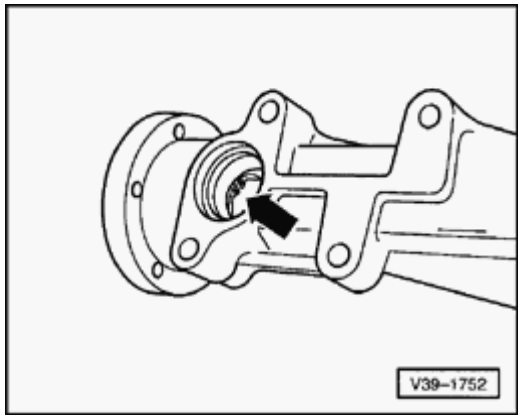
A - Internal puller 30-37 mm, e.g. Kukko 21/5

- Detach final drive support.

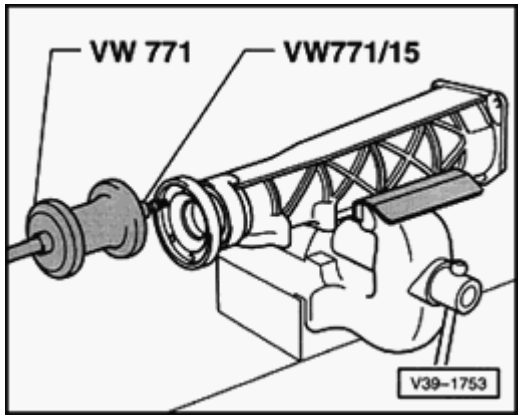


- Remove circlip -A-.
- Screw M8 bolt into thread in cover cap -B- and pull out cover cap.

39-93

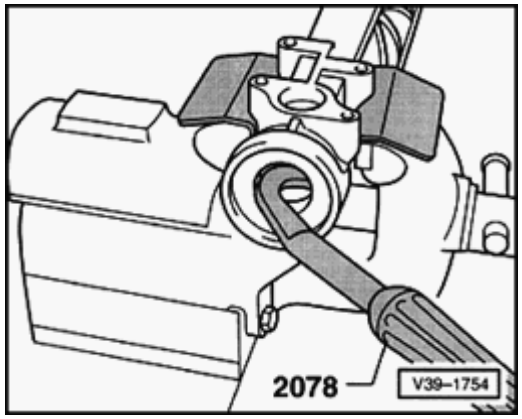


- Open out circlip (arrow) on drive flange and push circlip toward splines.

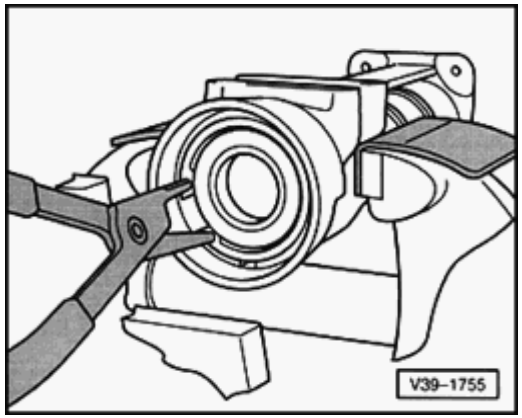


- Remove drive flange.
- Take circlip out of drive flange housing.

39-94

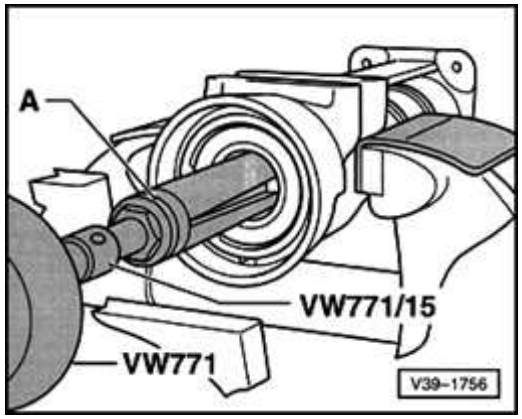


- Pry out seal.



- Remove circlip.

39-95



- Pull out grooved ball bearing for drive flange.

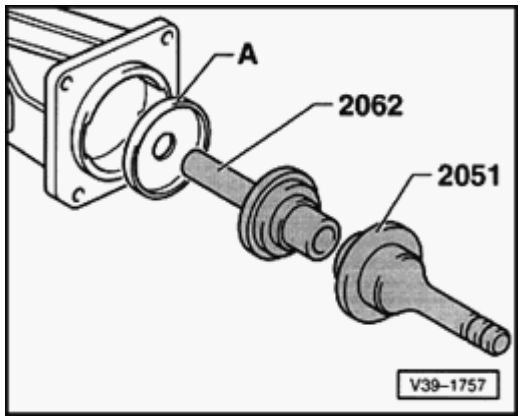
A - Internal puller 30-37 mm, e.g. Kukko 21/5

Note:

The bearing will be damaged when it is removed.

Only if baffle plate is damaged:

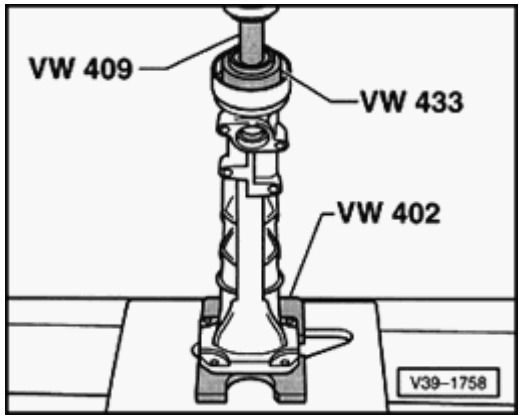
- If baffle plate is damaged, press it out with drive flange.



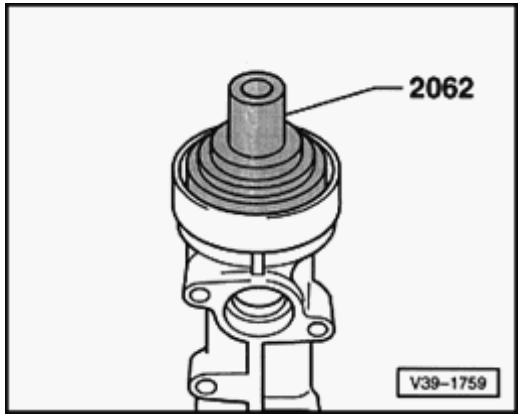
- To install, drive in baffle plate -A- onto stop.

39-96

Assembling

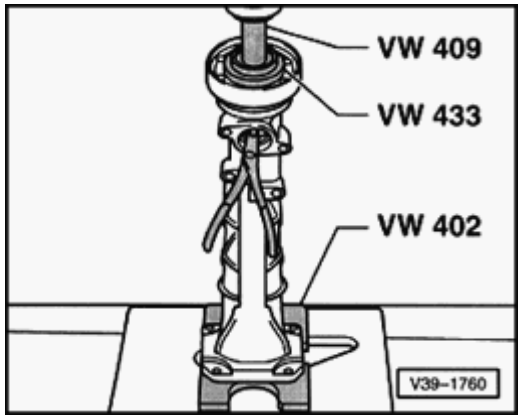


- Press grooved ball bearing into drive flange housing.
- Fit outer circlip.
- Pack space between sealing lip and dust lip of seal with sealing grease G52 128 A1.

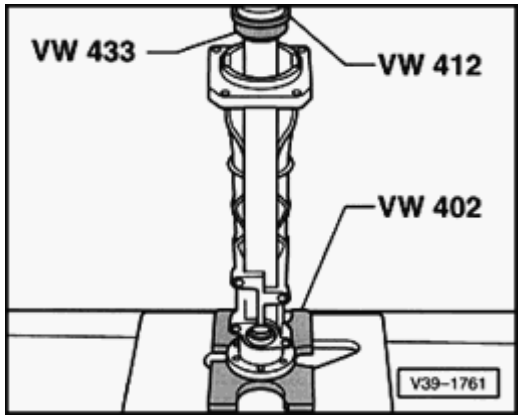


- Drive in seal onto stop.

39-97

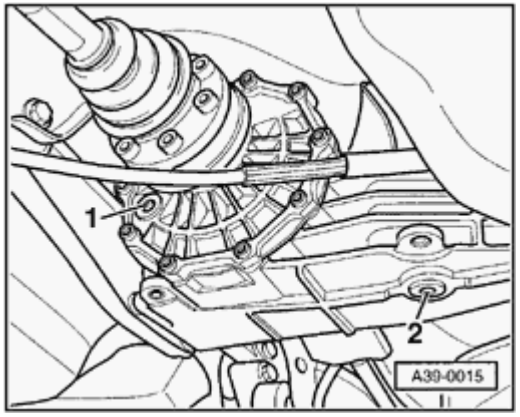


- Insert inner circlip in drive flange housing and hold in position with pliers; press in drive flange.
- Fit circlip in groove.



- Press sleeve onto drive flange as far as stop.
- Install cover cap with seal.
- Fit circlip.
- Install final drive support.
- Fit O-ring on drive flange housing.

Gear oil in rear final drive, checking

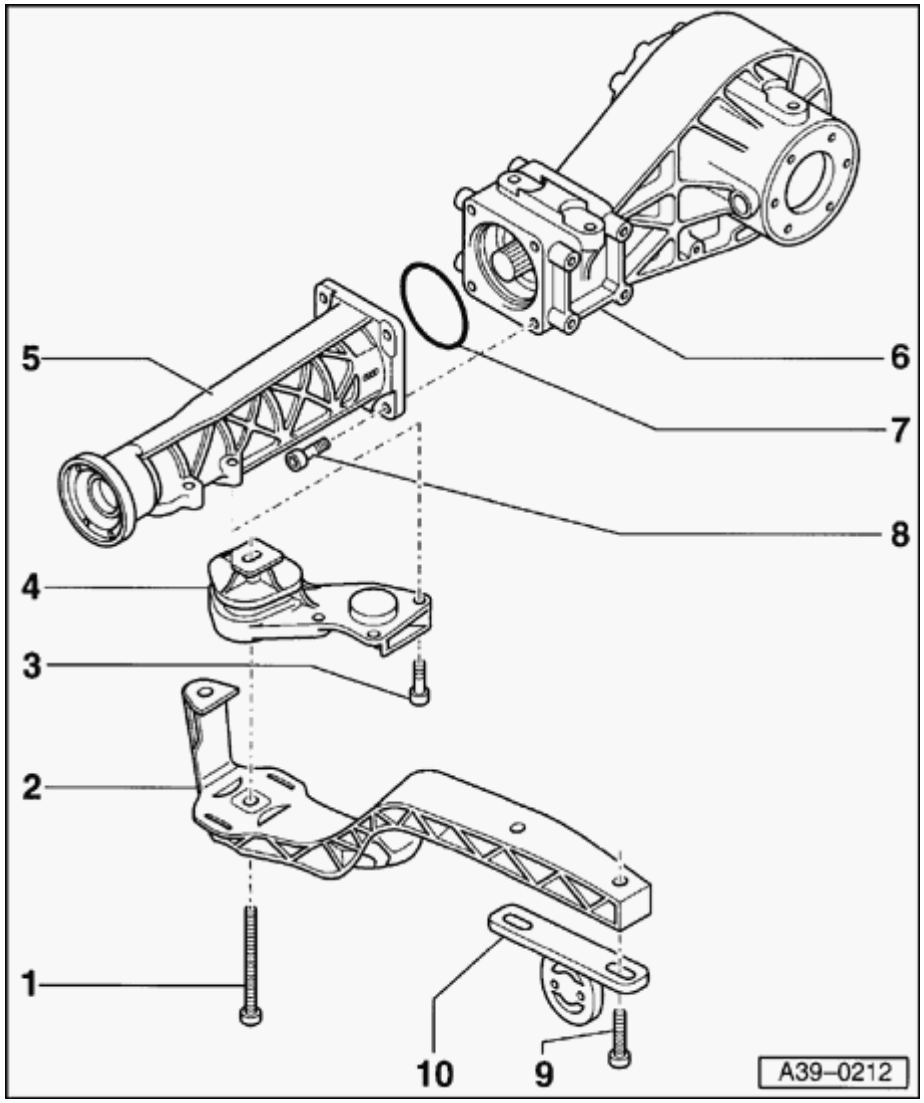


- Unscrew oil filler plug -1- for checking gear oil.
  - ♦ Specification: Oil level should reach lower edge of oil filler hole.
- If necessary, top up gear oil. Specification ⇒ page 00-25 .
- Install oil filler plug.

Tightening torque

Component	Nm
Oil filler plug	35

39-95



Torque tube, removing and installing

Assembly overview

1 - Bolt - 40 Nm

2 - Front crossmember

3 - Bolt - 40 Nm

4 - Transmission support

5 - Torque tube

6 - Rear final drive housing

7 - O-ring

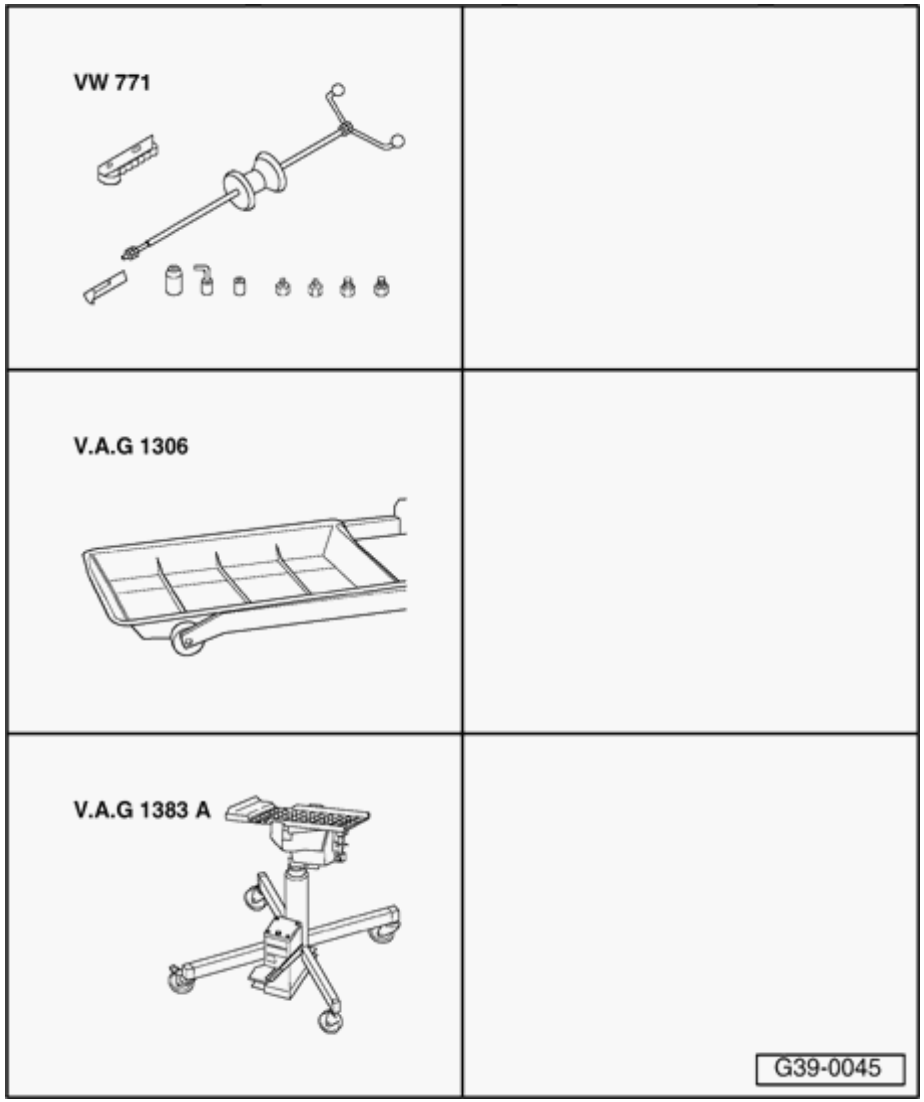
8 - Bolt - 35 Nm

9 - Bolt - 23 Nm

10 - Bracket

- For exhaust system

39-96



Removing

- Rear final drive installed

Special tools and equipment

- VW 771 slide hammer-complete set with 771/15 threaded piece
- VAG1306 drip tray
- Engine/transmission jack VAG1383A engine/gearbox jack

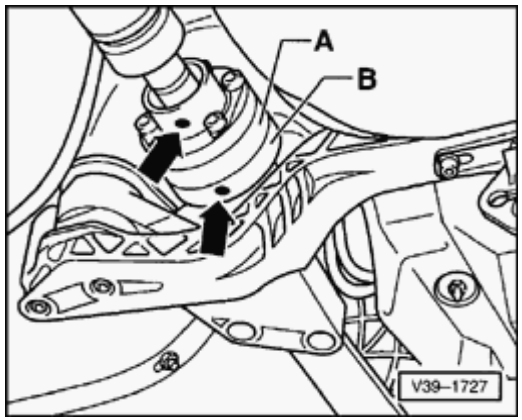
- Place VAG1306 drip tray underneath and drain gear oil.

- Remove rear part of exhaust system behind clamping sleeve(s):

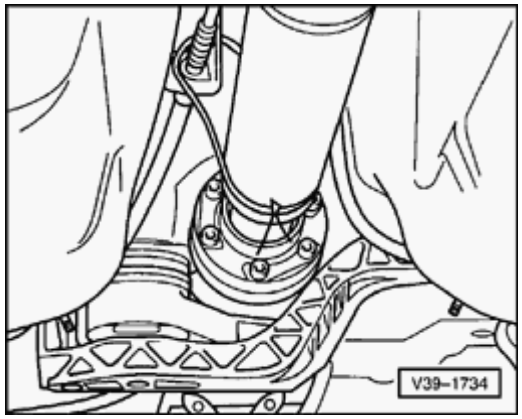
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Remove heat shields above driveshaft.

- Remove heat shield beside final drive.



- Check whether there is a factory marking (color marking) on the driveshaft. If not, mark location of driveshaft flange -A- to rear final drive -B- with color.
- Remove mounting bolts of driveshaft flange.

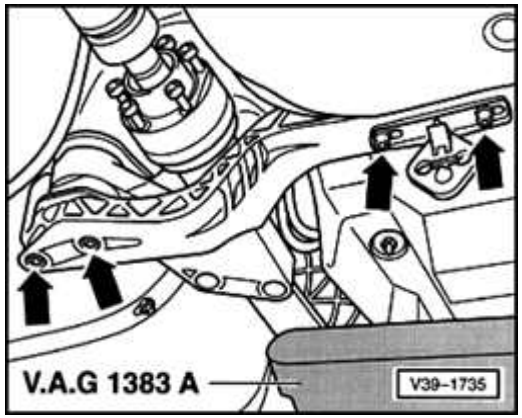


- Tie up driveshaft at mount for parking brake cable using wire.

Note:

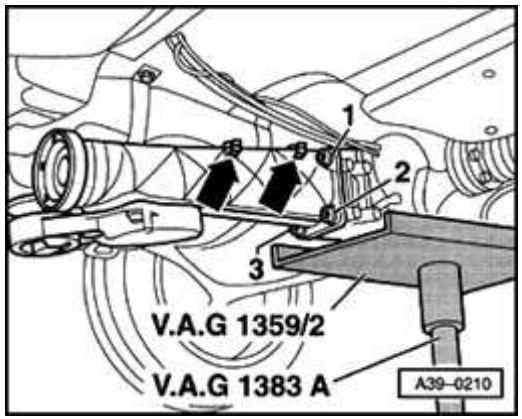
If the driveshaft cannot be pressed upward past the flange, tie up driveshaft after lowering final drive. When lowering, secure driveshaft against falling down and note permissible bending angle of driveshaft ⇒ Notes ⇒ page 39-73 .

- Support final drive using VAG1383A engine/transmission hoist.



- Remove bolts (arrows) at front crossmember for rear final drive.
- Remove front crossmember.

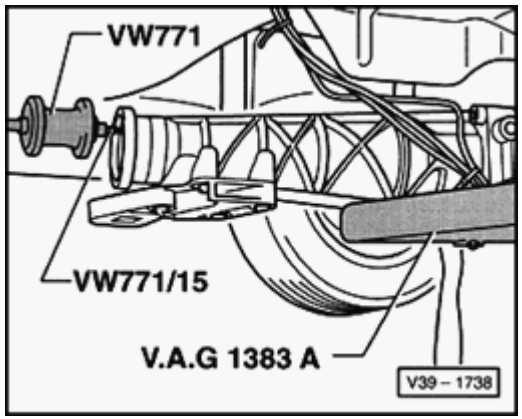
- Lower final drive approx. 10 cm.



- Remove 4 bolts for torque tube 1 to 3.

Note:

The 4. bolt is not visible in the illustration.



- Pull off flange shaft with torque tube.

Installing

Installation is reverse of removal, noting the following:

Notes:

- *After removing driveshaft, always remove any remaining locking fluid from thread holes in the transmission drive flanges and the rear final drive. Otherwise there is a possibility that the new bolts may get jammed when installed and shear when removed.*
- *Cleaning can be performed with a tap.*
- *Always replace seal between drive flange and driveshaft (remove protective film and attach seal to drive flange). Adhesive surface must be free of grease.*
- *Replace driveshaft bolts (self-locking).*

- Determine radial run-out at flange/driveshaft if a factory marking is present at the driveshaft ⇒ page 39-86 and adjust color marking at driveshaft to new marking at flange.

- Install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Top-up and check gear oil in rear final drive ⇒ page 39-94 .

Tightening torques

Component	Nm
Torque tube to rear final drive	35
Driveshaft to final drive (Input flange)	55
Front crossmember for rear final drive to body	40
Front crossmember for rear final drive with exhaust system bracket to body	23
Oil filler plug	35
Nuts for clamping sleeve	40

Drive flange oil seals, replacing

- Rear final drive installed

- Observe general repair instructions ⇒ Page 00-11 .

Note:

The exhaust system only needs to be removed if the left oil seal is replaced.

Special tools, testers and auxiliary items

- Drift 2062
- Drip tray V.A.G 1306
- Universal support V.A.G 1359/2
- Engine/transmission jack V.A.G 1383 A

39-99

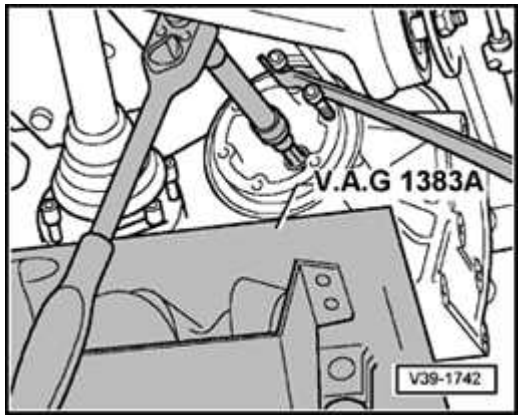
Removing

- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

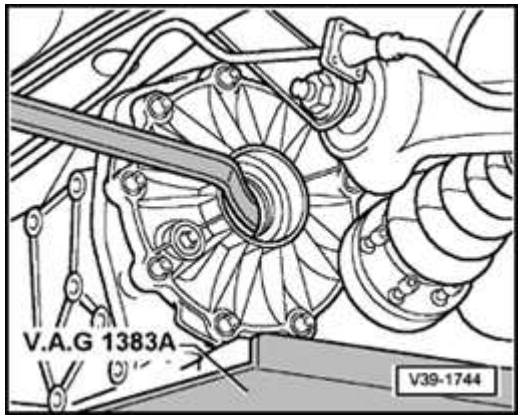
- Detach left and right-hand drive axles from rear final drive, and lay to one side:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42.*



- Remove drive flange. To loosen securing bolt, screw two bolts into drive flange and hold with bar to prevent it from turning.
- Place drip tray V.A.G 1306 underneath and drain transmission oil.
- Pull out drive flange using the bolts already screwed in.

39-100

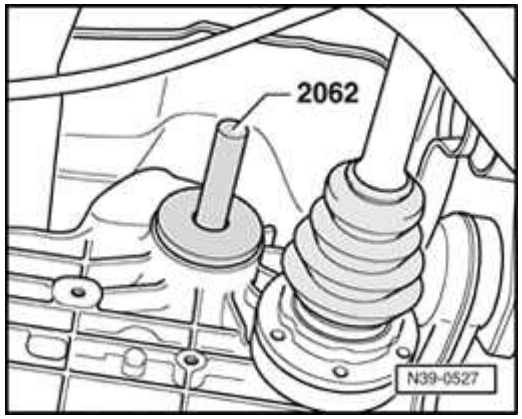


- Pry out drive flange oil seal with a suitable lever.

Installing

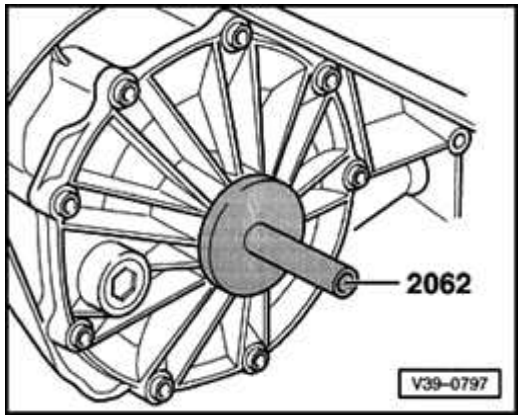
Installation is carried out in the reverse order, when doing this note the following:

- Clean seat for oil seal.
- Moisten outer circumference of seal with gear oil.
- Fill space between sealing lip and dust lip with sealing grease G52 128 A1.



- Drive in oil seal for left drive flange onto stop with mandrel 2062, taking care to keep the seal straight.

39-101



- Drive in oil seal for right drive flange onto stop with mandrel 2062, ensuring that seal is kept straight.
- Bolt on driveshaft.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42.*

- Align exhaust system free of stress.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Top up gear oil in rear final drive and check oil level ⇒ Page 39-80 .

Tightening torque

Component		Nm
Drive flange to final drive		25
Drive axle to flange shaft	M8	40
	M10	77

Rear final drive, removing and installing

Special tools, testers and auxiliary items

- Universal support V.A.G 1359/2
- Engine/transmission jack V.A.G 1383 A

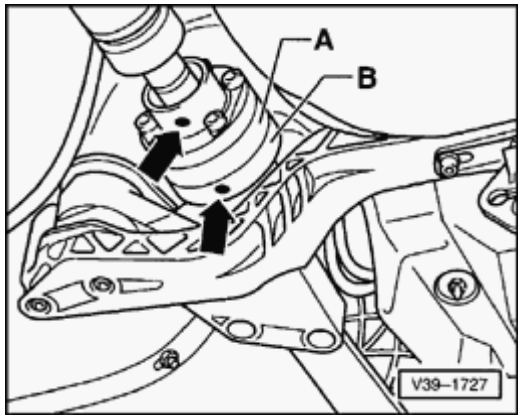
Removing

- Remove rear section of exhaust system (rearward of exhaust pipe clamp(s)):

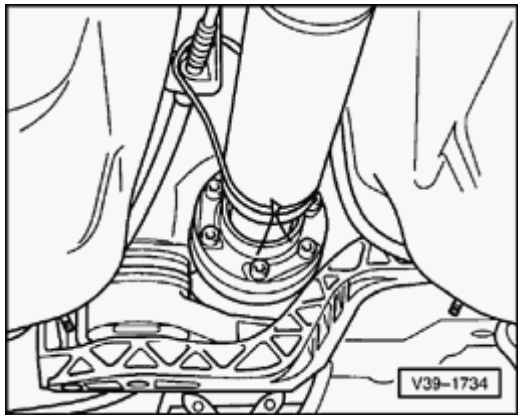
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

- Remove heat shield above driveshaft.

39-103



- Check whether there is a factory marking (paint spot) on the driveshaft. If not, mark the position of the driveshaft flange -A- in relation to the rear final drive (arrow -B-) with paint.
- Unscrew bolts from driveshaft flange.



- Secure driveshaft to parking brake cable bracket with wire.

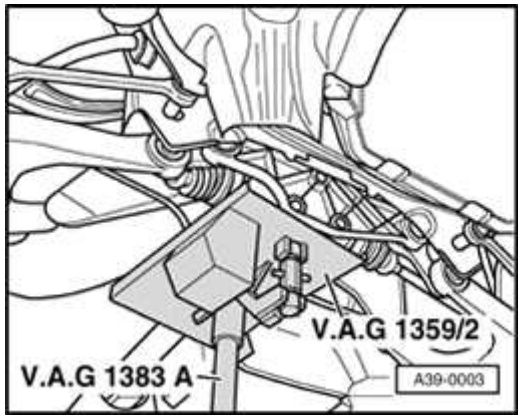
Note:

If it is not possible to push the driveshaft up and off the flange, lower the final drive before tying up the driveshaft. When lowering the final drive, prevent the driveshaft from dropping down, and do not bend the center joint further than the maximum angle permitted ⇒ *Page 39-64 , Notes.*

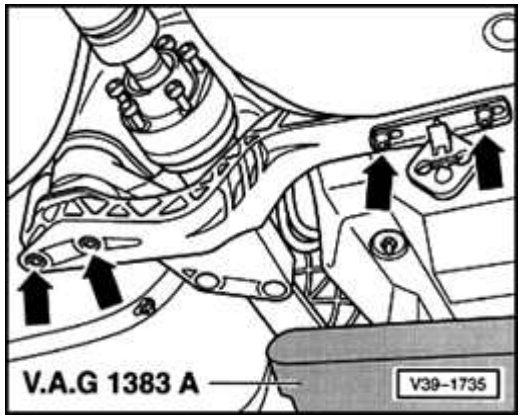
- Disconnect left and right-hand drive axles from rear final drive.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42.*

39-104

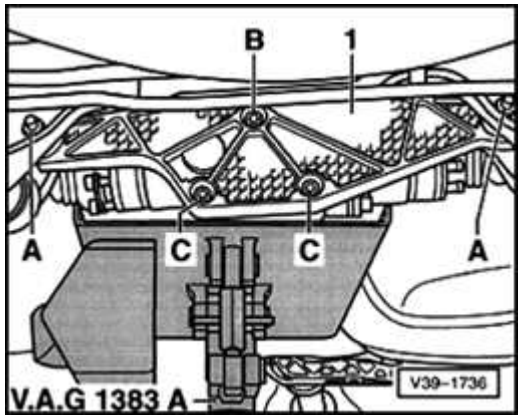


- Support final drive with transmission jack V.A.G 1383 A and universal support V.A.G 1359/2.
- Secure final drive with a strap.



- Unscrew bolts (arrows) on front cross member for rear final drive.
- Disconnect front cross member.

39-105



- Unscrew securing bolts -B- and -C- of rear cross member on rear final drive.
- Lower final drive on transmission jack.

Note:

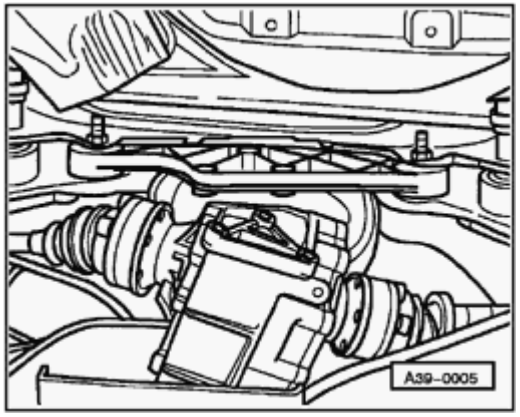
The cross member -1- need not be removed.

Installing

Installation is carried out in the reverse order, when doing this observe the following:

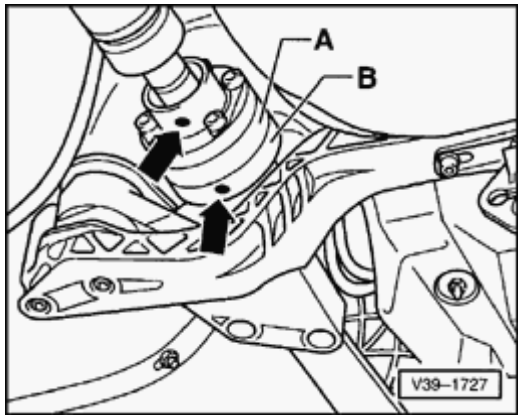
Note:

- *Always replace self-locking nuts.*
- *It is essential to clean out the locking fluid remaining in the threads in the drive flange on the rear final drive after removing the driveshaft. Otherwise there is a danger that the new bolts will seize when they are screwed in and then shear if they have to be removed later.*
- *The threaded holes can be cleaned with a thread tap.*
- *Replace gasket between driveshaft and drive flange (pull off backing foil and stick gasket onto drive flange). Surface must be free of grease.*
- *Replace driveshaft bolts (self-locking).*



- Raise final drive with transmission jack until both drive axles can be connected.
- Lightly tighten securing bolts for drive axles.
- Lift final drive and bolt to cross member and final drive support.
- Bolt on driveshaft ⇒ Page 39-71 .

Note:



- *To prevent imbalance, the flanges on the driveshaft -A- and on the rear final drive -B- must be installed so that the paint markings are in alignment (arrows).*
- *After removing the driveshaft from the rear final drive, the additional balance disk (thick washer) that may be located between the lock plate and the bolt head must not be reinstalled. Always replace all flange bolts after disassembling.*
- *Replace driveshaft bolts (self-locking).*

- Check gear oil in rear final drive ⇒ Page 39-80 .

- Align exhaust system free of stress.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Engine Mechanical, Engine Code(s): APB, Repair Group 26*

Tightening torques

Component	Nm
Driveshaft to final drive (drive flange)	55
Front cross member for rear final drive to body	40
Front cross member for rear final drive and exhaust bracket to body	23
Rear cross member for rear final drive to subframe	50
Rear cross member to rear final drive	55

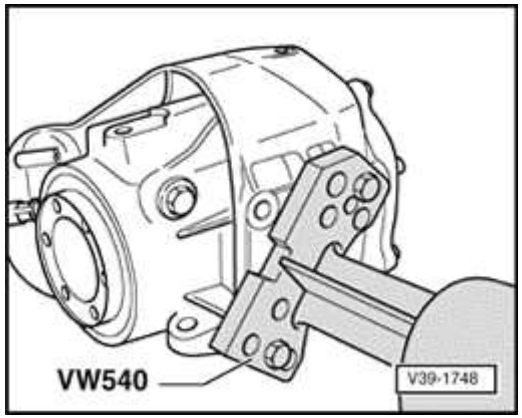
Driveshaft to drive flange	M8	40
	M10	77

39-108

Rear final drive, securing to repair stand

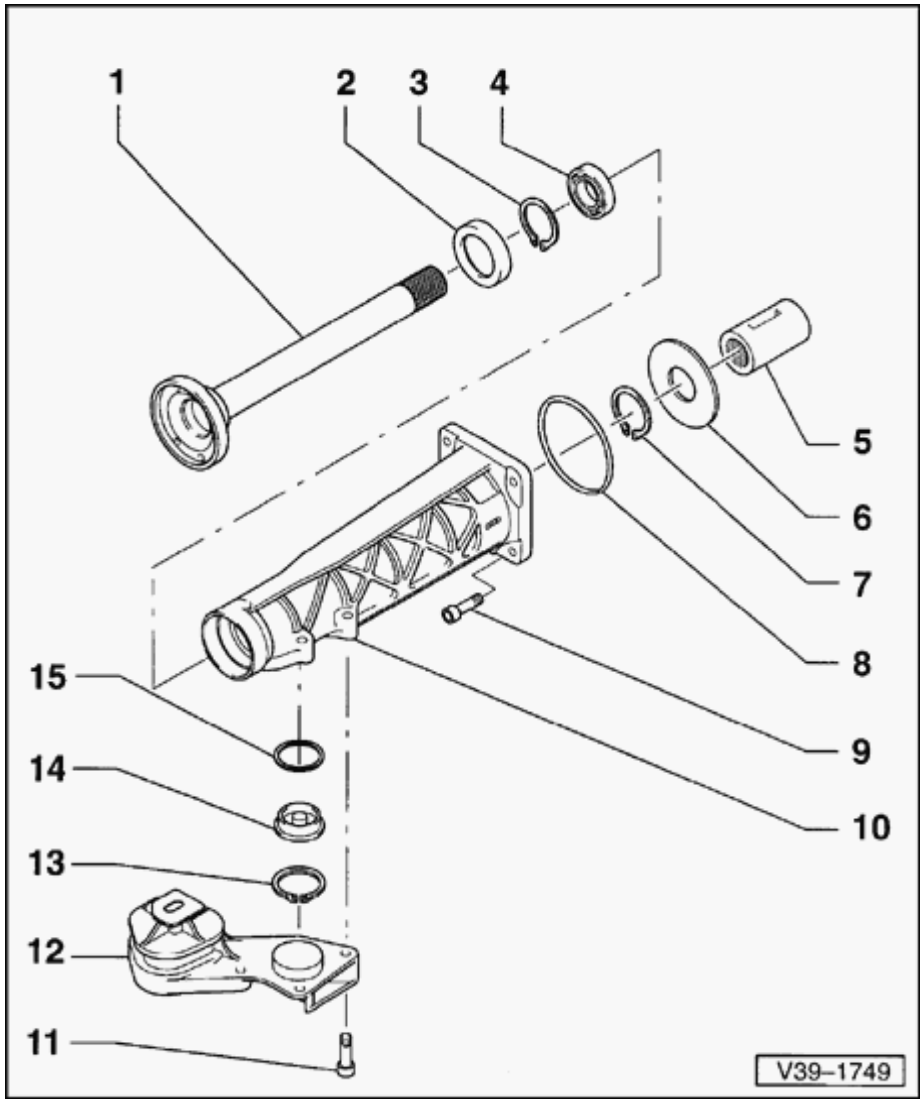
Special tools, testers and auxiliary items

- Engine/transmission support VW 540



- Secure complete rear final drive to a repair stand with engine and transmission support VW 540.

39-102



Torque tube, disassembling, assembling and overview

Note:

Torque tube, removing and installing ⇒ *page 39-95* .

1 - Drive flange

- Removing ⇒ page 39-108
- When installing, circlip item 7 - must be inserted into hole in housing at the same time ⇒ page 39-112

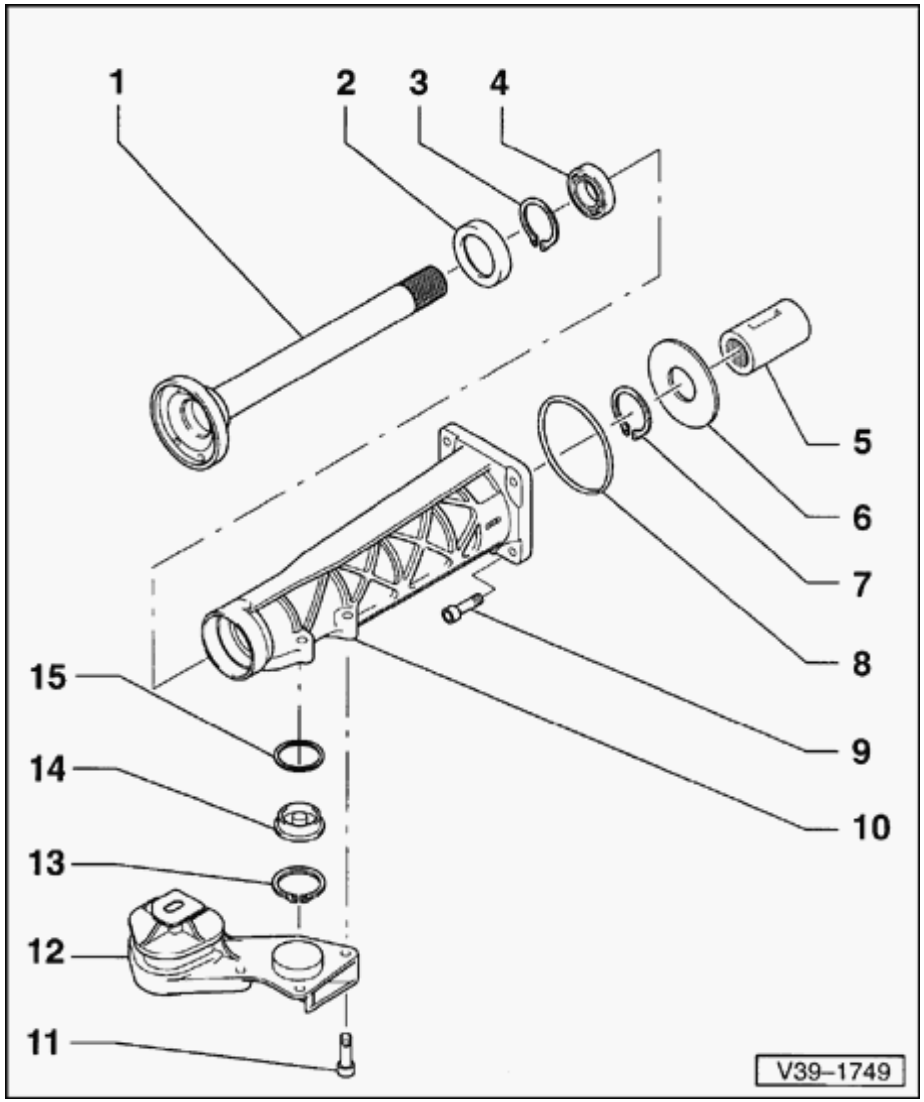
2 - Seal

- Levering out ⇒ page 39-109
- Driving in ⇒ page 39-111

3 - Snap ring

- Removing ⇒ page 39-109

39-103



4 - Grooved ball bearing for drive flange

- Pulling out ⇒ page 39-110
- Pressing in ⇒ page 39-111

5 - Sleeve

- Pulling off ⇒ page 39-107
- Pressing on ⇒ page 39-112

6 - Diaphragm plate

- Only press out if damaged
- Installing ⇒ page 39-110

7 - Snap ring

- Spread for removing flange shaft ⇒ page 39-108

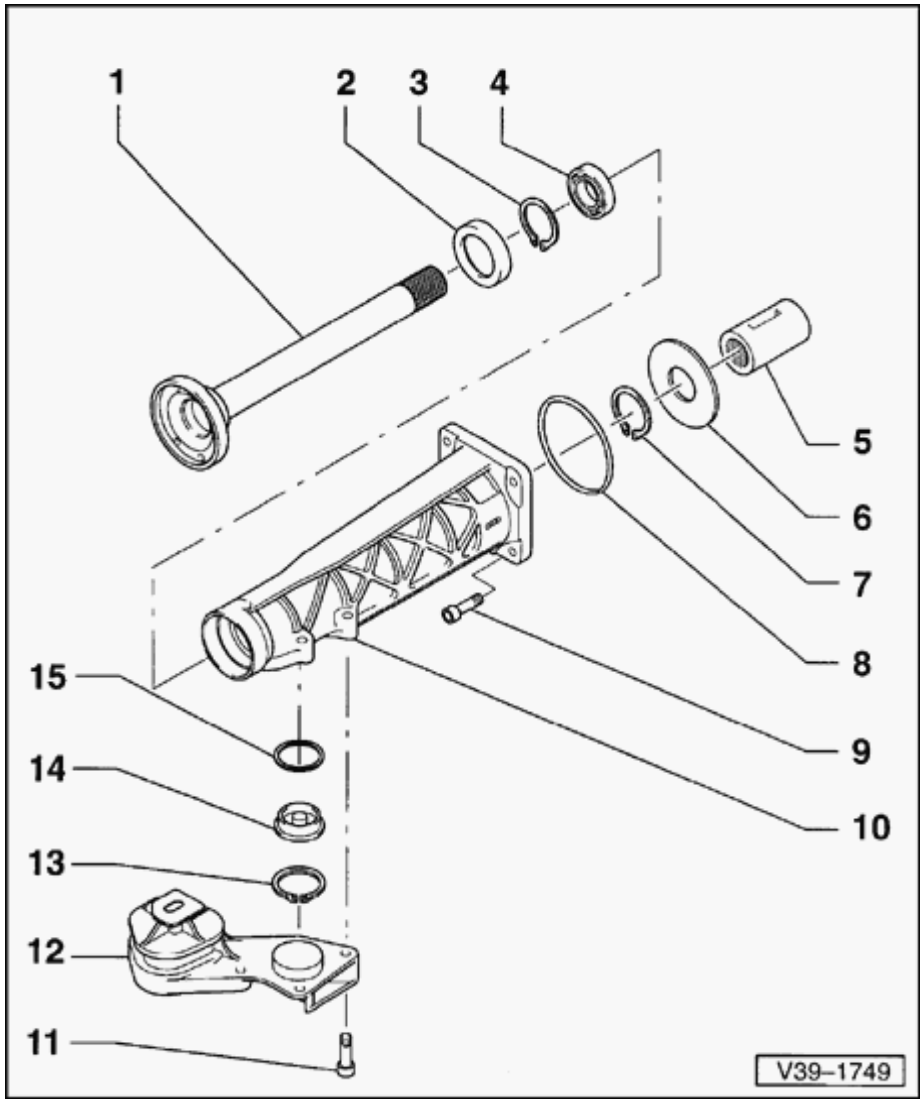
8 - O-ring

- Always replace

9 - Bolt - 35 Nm

- For securing torque tube to rear final drive housing

39-104



10 - Torque tube

11 - Bolt - 40 Nm

- For securing final drive mount to torque tube

12 - Transmission support

13 - Snap ring

- Removing ⇒ page 39-107

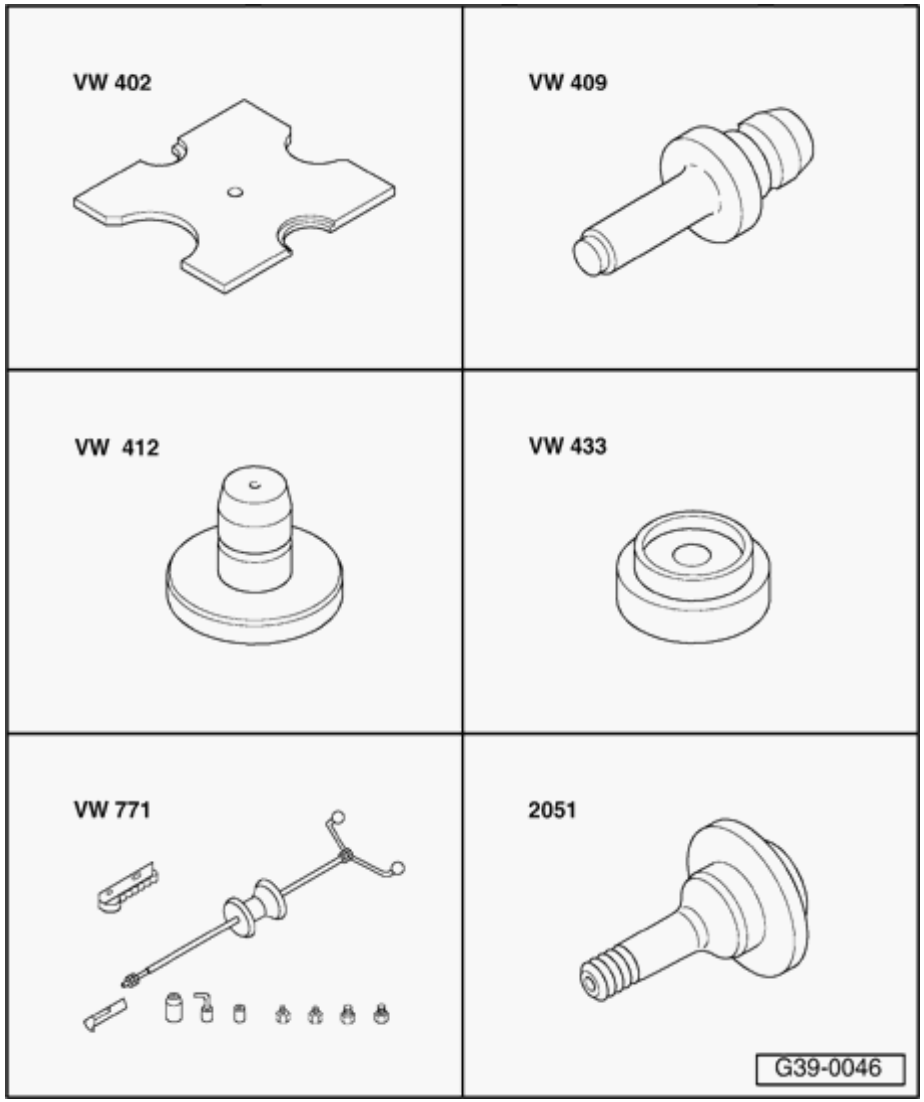
14 - Concealment cap

- Removing ⇒ page 39-107

15 - O-ring

- Always replace

39-105

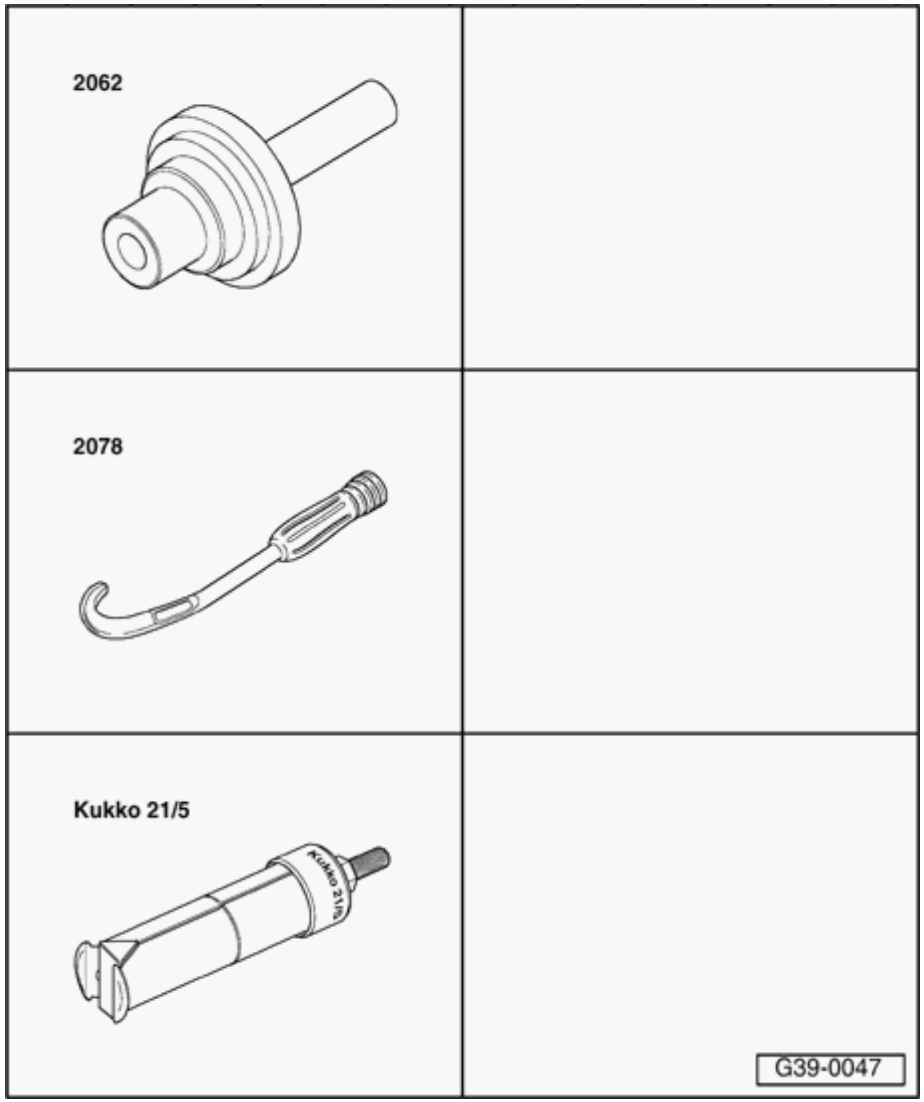


Torque tube, disassembling and assembling

Special tools and equipment

- VW402 thrust plate
- VW409 punch
- VW412 punch
- VW433 thrust pad
- VW 771 slide hammer-complete set with 771/15 threaded piece
- 2051 arbor

39-106



- 2062 driver
- 2078 tappet tensioner
- Kukko 21/5 extractor

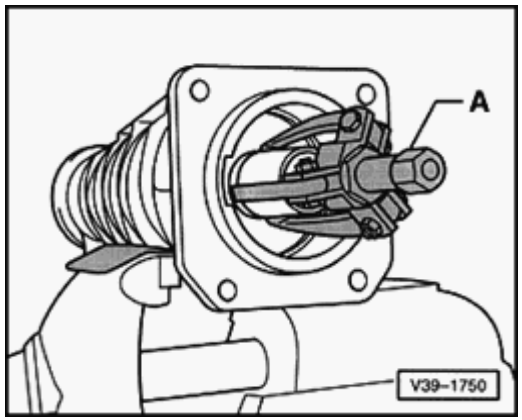
39-107

Note:

Removing and installing torque tube ⇒ *page 39-95* .

Disassembly

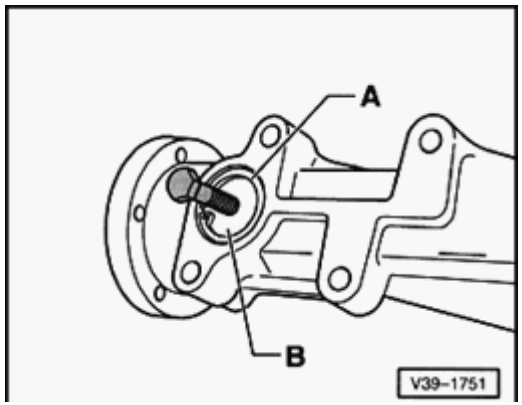
- Clamp torque tube in vise with protective pads.



- Pull off sleeve.

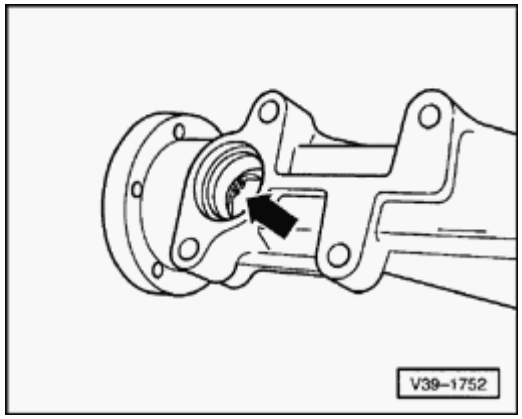
A - Internal puller 30 to 37 mm, e.g. Kukko 21/5 extractor

- Remove transmission mount.

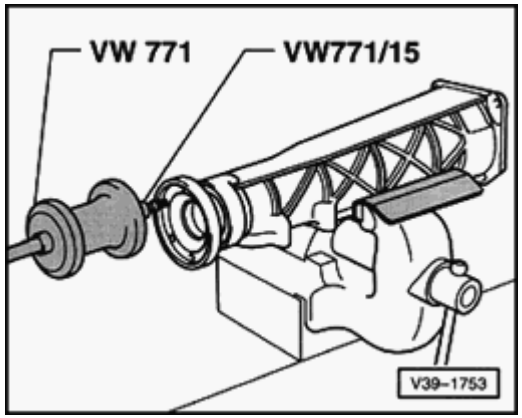


- Remove circlip -A-.
- Thread M8 bolt into threaded hole of cap -B- and pull out cap.

39-108

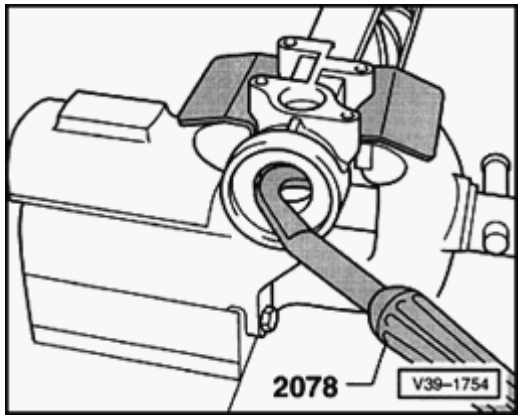


- Expand circlip -arrow- on flange shaft and slide in direction of splines.

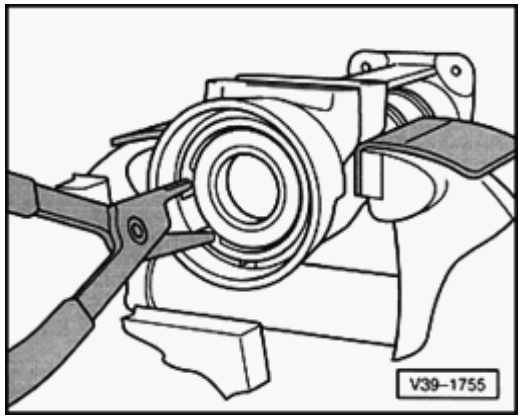


- Remove drive flange.
- Remove circlip from torque tube.

39-109

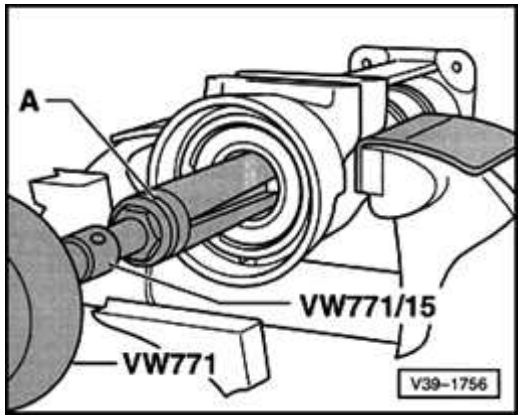


- Pry out gasket.



- Remove circlip.

39-110



- Pulling out grooved ball bearing for drive flange.

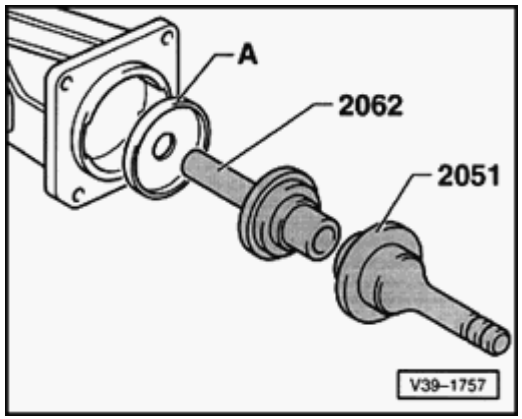
A - Internal puller 30 to 37 mm, e.g. Kukko 21/5 extractor

Note:

The bearing is damaged during removal.

Only if the diaphragm plate is damaged:

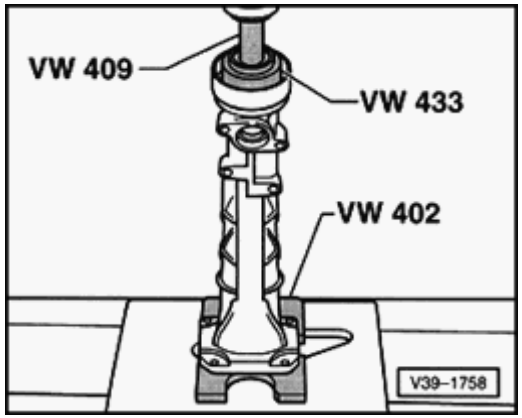
- If the diaphragm plate is damaged, press it out together with drive flange.



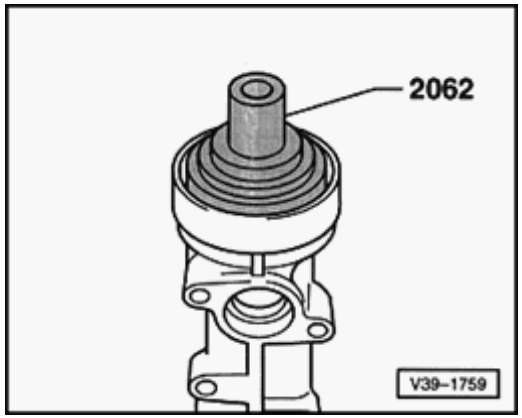
- To install, drive in diaphragm plate -A- up to stop.

39-111

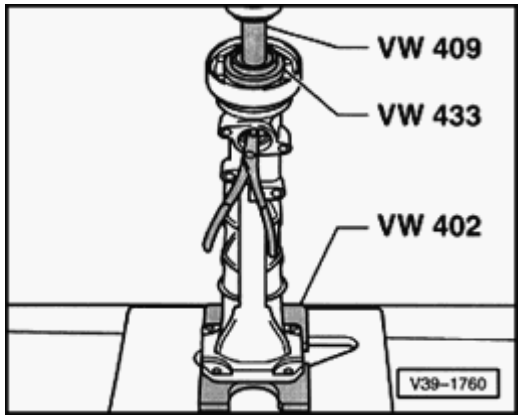
Assembly



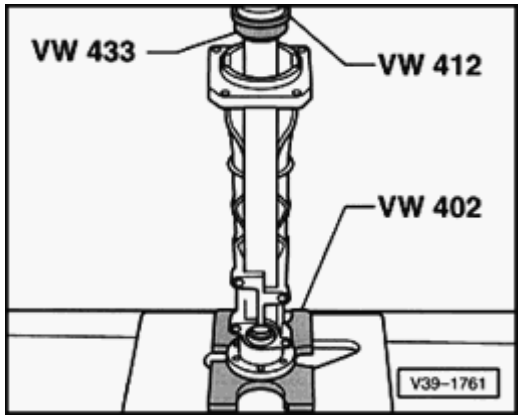
- Press grooved ball bearing into torque tube.
- Insert outer circlip.
- Fill seal between sealing lip and dust lip with multi-purpose grease.



- Drive in seal to stop.



- Insert circlip into torque tube and hold using pliers, press in drive flange.
- Insert circlip into groove.



- Press sleeve onto drive flange up to stop.
- Install cap with seal.
- Insert circlip.
- Install final drive mount.
- Position O-ring on torque tube.

Rear final drive, removing and installing

Special tools and equipment

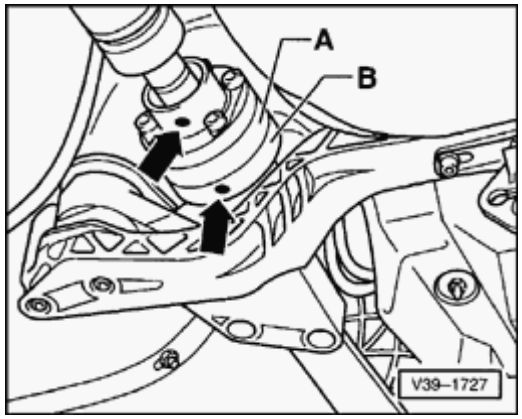
- VAG1359/2 universal transmission attachment
- VAG1383A transmission jack

Removing

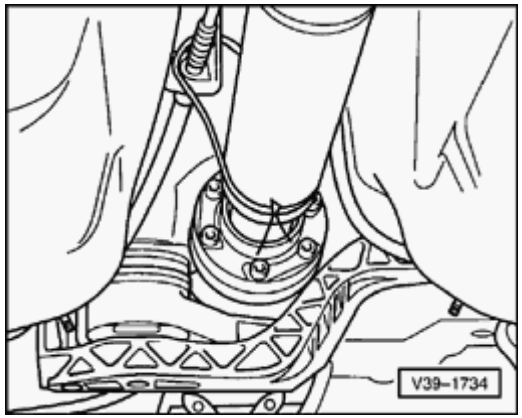
- Remove rear section of exhaust system located rearward of exhaust pipe clamp(s).

⇒ Repair Manual, Engine Mechanical, Repair Group 26

- Remove heat shield above driveshaft.



- Check for factory color marking on driveshaft. If not, mark position of driveshaft flange (arrow -A-) in relation to drive flange in rear final drive (arrow -B-) with color marking.
- Remove mounting bolts from driveshaft flange.



- Tie driveshaft to parking brake cable using wire.

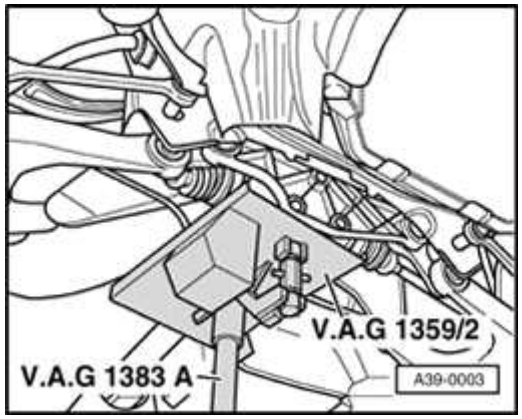
Note:

If the driveshaft cannot be pushed up past the flange, tie up the driveshaft after lowering the differential. When lowering the driveshaft, protect it from dropping and note permissible bend angle of the driveshaft ⇒ Notes, ⇒ Page 39-68 .

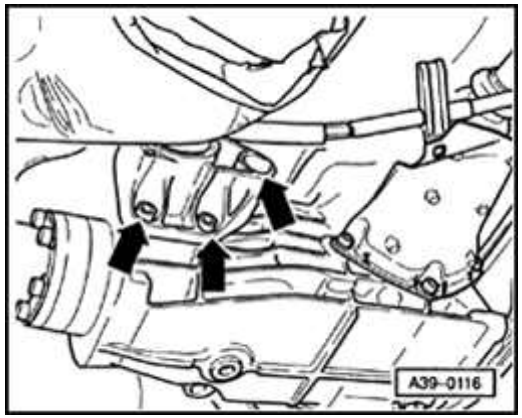
- Disconnect left and right driveaxles from final drive.

⇒ *Repair Manual, Suspension, Wheels, Brakes, Steering, Repair Group 42*

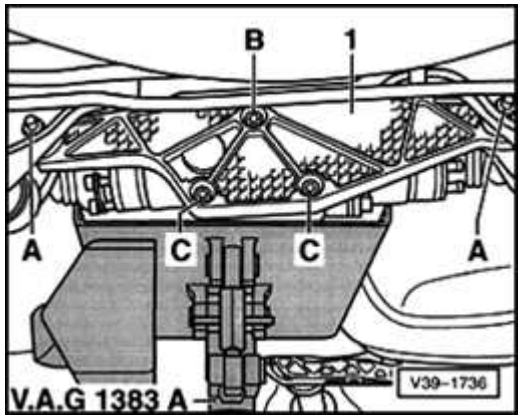
39-106



- Place VAG1383A transmission jack with 1359/2 universal transmission attachment under final drive and support weight of final drive.
- Fasten final drive using belt.



- Remove mounting bolts (arrows) of front crossmember for final drive.
- Remove front crossmember.



- Remove mounting bolts -B- and -C- from rear crossmember at final drive.
- Lower final drive using transmission hoist.

WARNING!

For sefety reasons, two persons are required for lowering the final drive, and raising it again for installation.

Note:

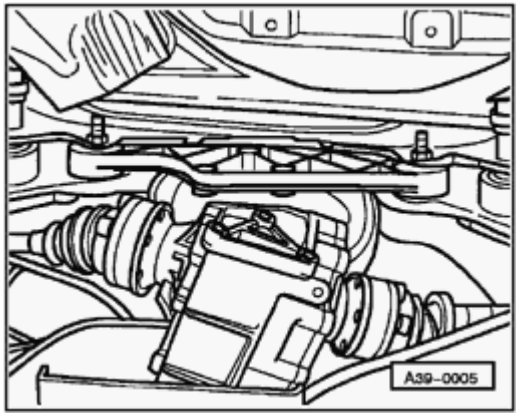
Crossmember -1- does not need to be removed.

Installing

Installation is the reverse of removal, note the following:

Notes:

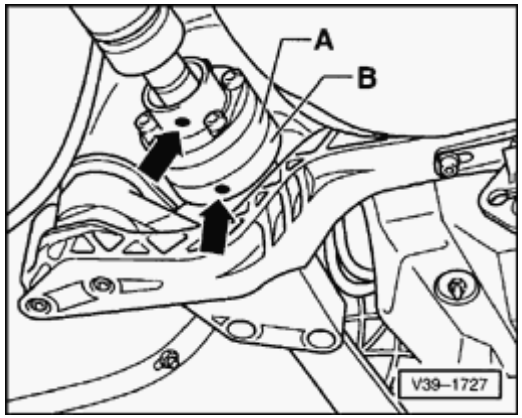
- *Always replace self-locking nuts.*
- *Always replace self-locking driveshaft bolts.*
- *The threaded holes on the drive flange on the final drive should be cleaned of all locking compound residue after driveshaft has been removed. Otherwise there is a risk of seizing the bolt when tightening and subsequently breaking off at the next disassembly.*
- *The threads can be cleaned using a thread tap.*
- *Replace seals between driveshaft and drive flange (remove protective film and bond seal to drive flange. Adhesive bond surface must be free of grease.*



- Use transmission hoist, to raise final drive far enough until both drive axles can be installed.
- Tighten drive axle bolts slightly.
- Raise final drive and bolt to crossmember and transmission support.
- Install drive shaft ⇒ Page 39-74 .

Notes:

- *Always replace self-locking bolts for driveshaft.*



- *To prevent imbalance, the flanges of the driveshaft (arrow -A-) and of the final drive (arrow -B-) must be installed so that the factory color markings (or the color markings made during removal) are aligned.*
- *After removing driveshaft from final drive, additional balance disc (thicker washer) which may have been installed between base plate and bolt head may not be re-installed.*
- Check oil level in final drive ⇒ Page 39-84 .

- Align exhaust system free of stress.

⇒ Repair Manual, Engine Mechanical, Repair Group 26

Tightening torques

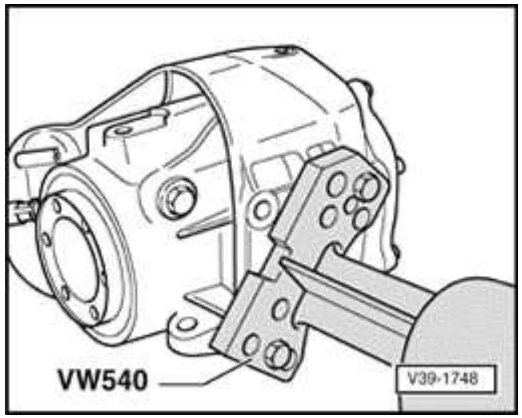
Component		Tightening torque
Driveshaft to final drive		55 Nm (41 ft lb)
Front crossmember for final drive to body		40 Nm (30 ft lb)
Front crossmember for differential with mounting bracket for exhaust system to body		23 Nm (17 ft lb)
Rear crossmember for final drive to subframe		50 Nm (37 ft lb)
Rear crossmember to final drive		55 Nm (41 ft lb)
Drive axle to drive flange	M8	40 Nm (30 ft lb)
	M10	80 Nm (59 ft lb)

39-110

Rear final drive to repair stand, mounting

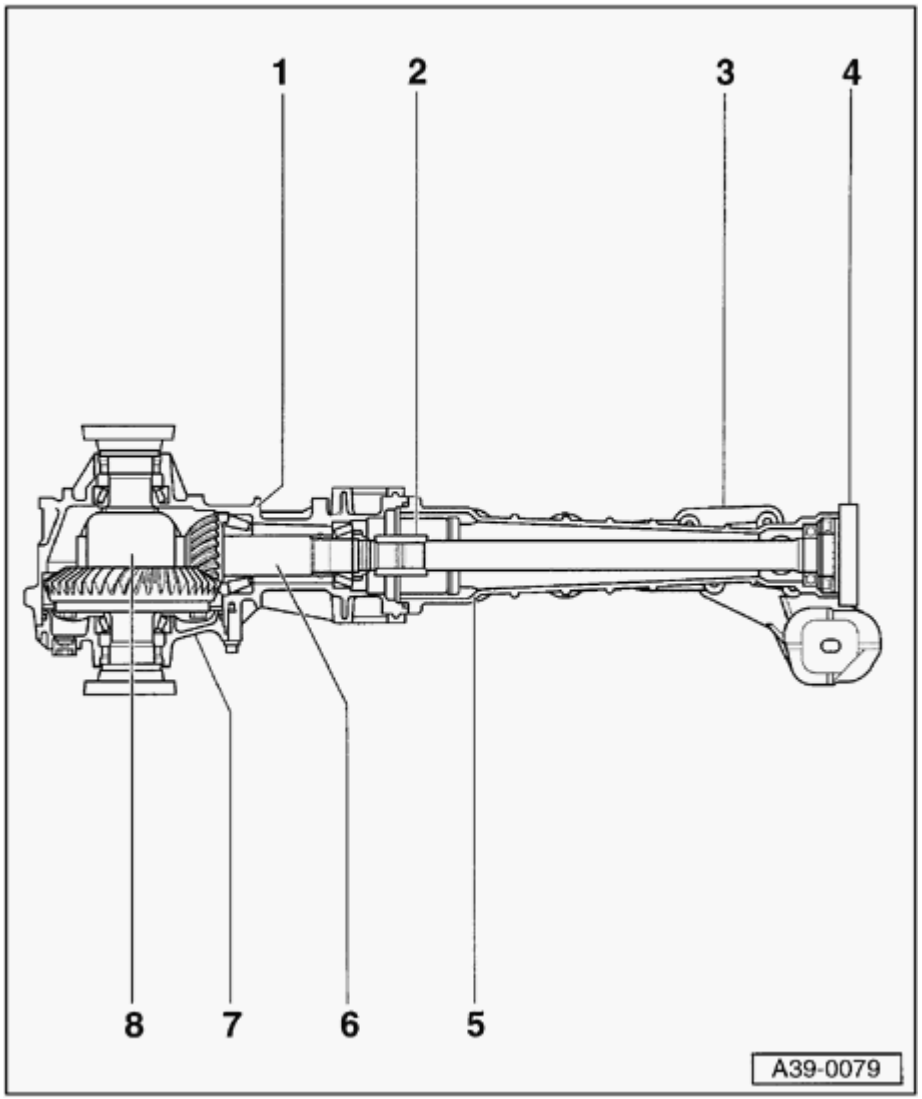
Special tools and equipment

VW540 holding fixture



- Mount complete final drive to repair stand using VW540 holding fixture.

39-109



Rear final drive, disassembling and assembling

Rear final drive, overview

Note:

- *Removing drive flange housing from rear final drive with final drive installed ⇒ Page 39-81 .*
- *Removing drive flange housing from rear final drive with final drive removed ⇒ Page 39-111 .*

1 - Final drive housing

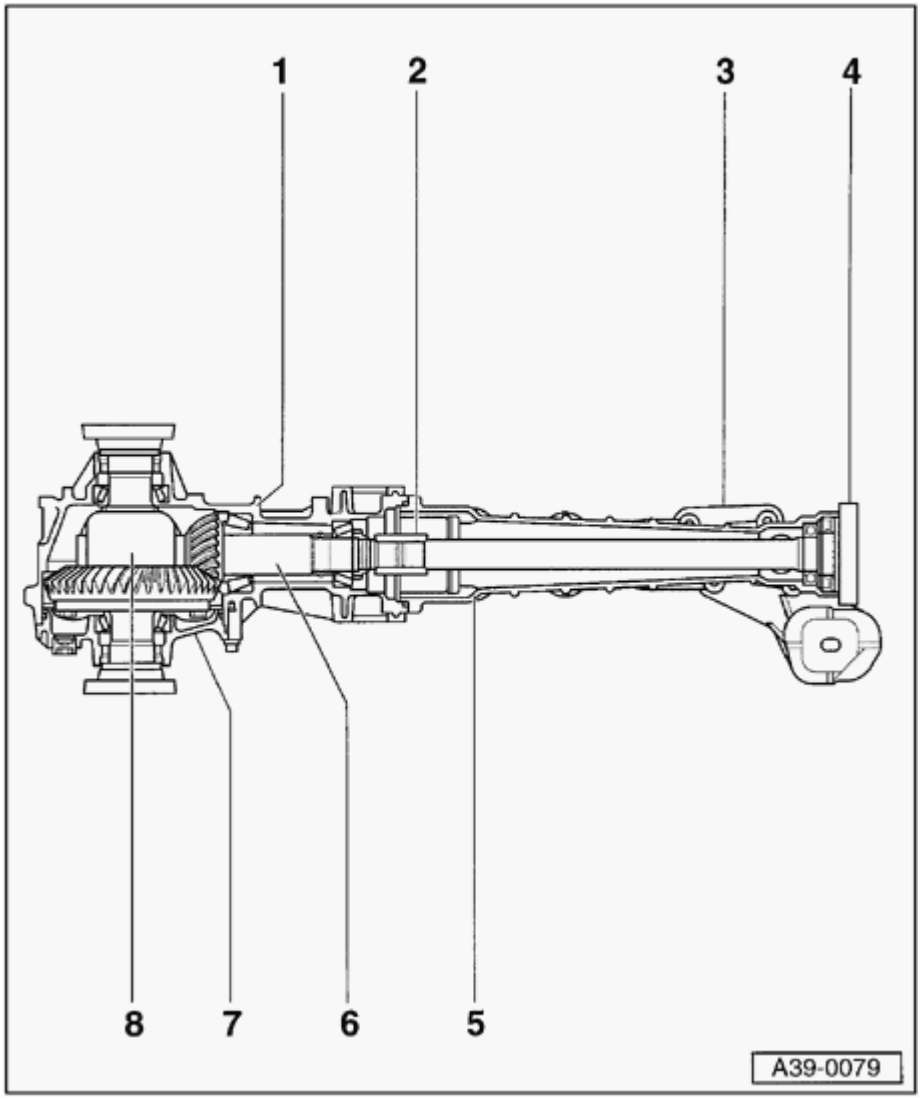
2 - Sleeve

3 - Final drive support

4 - Flange for driveshaft

- Removing ⇒ Page 39-93

39-110



5 - Drive flange housing

- Removing and installing ⇒ Page 39-81

6 - Drive pinion

- Paired with ring gear
- Removing and installing drive pinion ⇒ Page 39-134

7 - Cover for final drive

8 - Differential

- Must be removed before disassembling drive pinion
- Removing and installing ⇒ Page 39-112
- Disassembling and assembling ⇒ Page 39-120

39-111

Removing drive flange housing from rear final drive

- Rear final drive removed

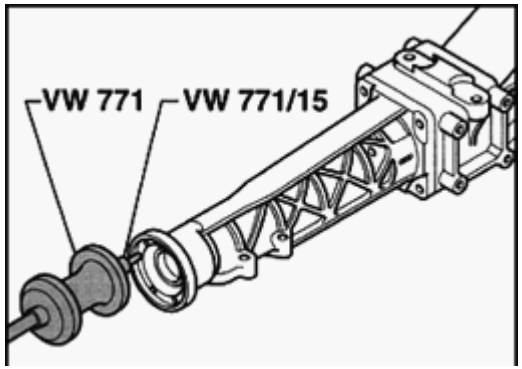
Special tools, testers and auxiliary items

- Multipurpose tool VW 771 and 771/15
- Drip tray V.A.G 1306

- Secure rear final drive to repair stand ⇒ Page 39-108 .

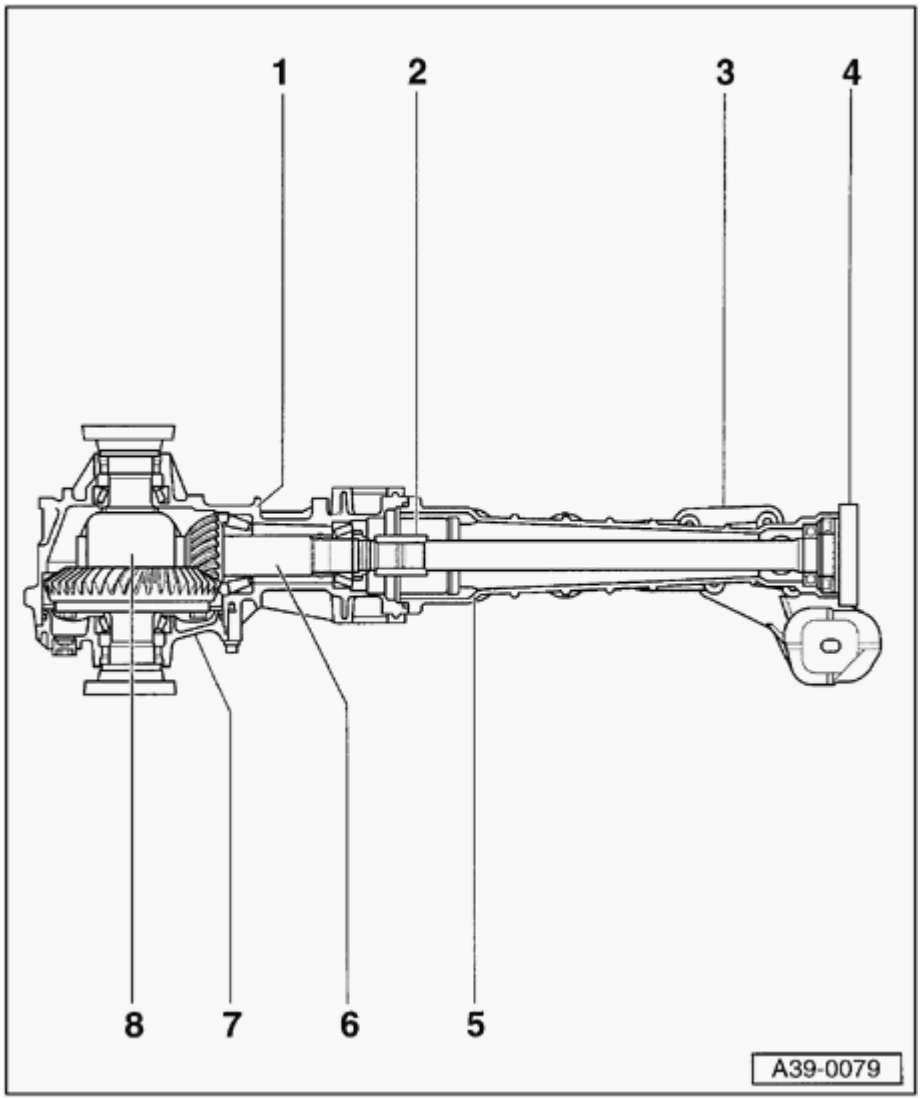
- Place drip tray V.A.G 1306 underneath and drain transmission oil.

- Remove bolts securing the drive flange housing to rear final drive housing.



- Pull off drive flange housing with drive flange ; when doing this, support drive flange housing.

39-111



Rear final drive, disassembling and assembling

Assembly overview

Notes:

- *Separating drive flange housing from final drive with the final drive installed* ⇒ *Page 39-85*
- *Separating drive flange housing from final drive with the final drive removed* ⇒ *Page 39-113*

1 - Final drive housing

2 - Sleeve

3 - Transmission support

4 - Drive flange

- Removing ⇒ Page 39-93

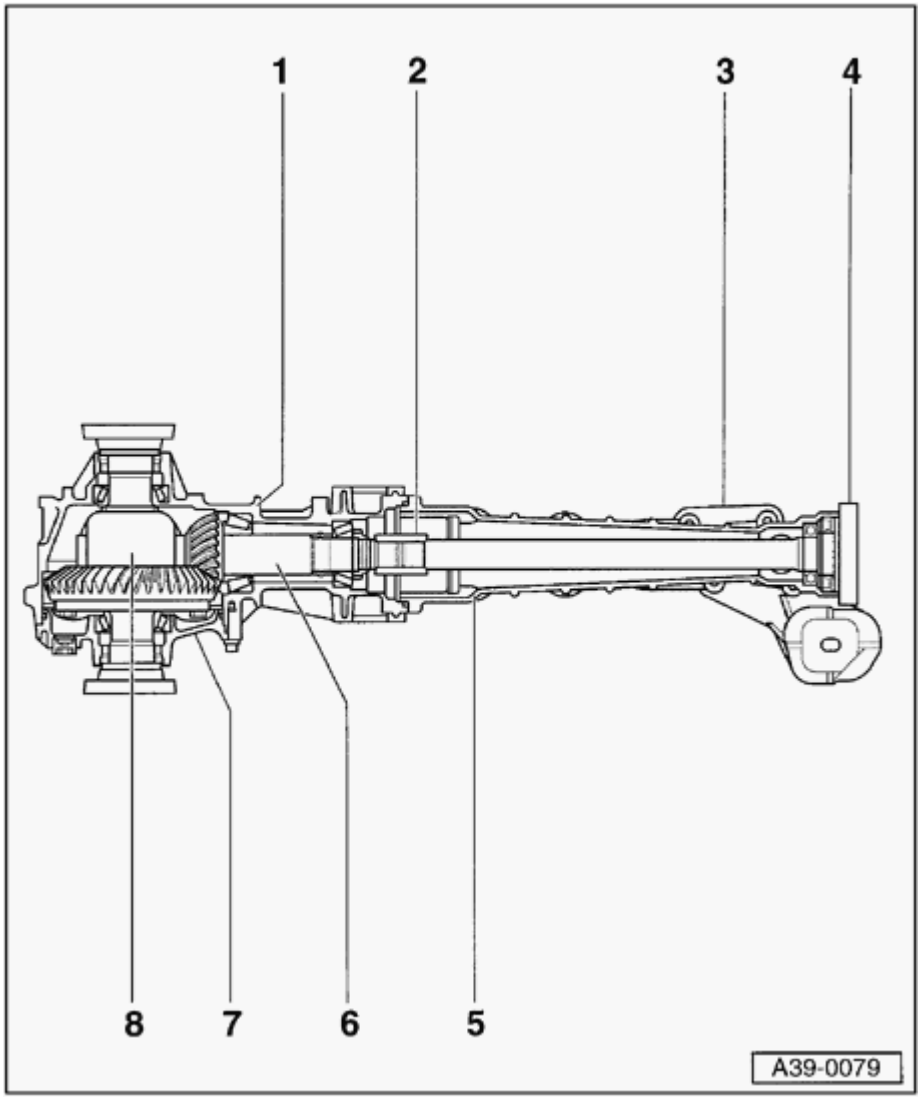
5 - Drive flange housing

- Removing and installing ⇒ Page 39-85

6 - Pinion shaft

- Is matched with ring gear, always replace together as a set.
- Removing and installing ⇒ Page 39-134

39-112



7 - Final drive cover

8 - Differential

- Must be removed before removing pinion shaft
- Removing and installing ⇒ Page 39-114
- Disassembling and assembling ⇒ Page 39-121

39-113

Drive flange housing, removing from final drive housing

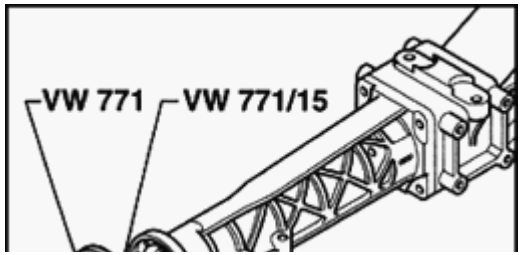
- Final drive removed.

Special tools and equipment

- VW771 slide hammer-complete set with 771/15 threaded piece
- VW1306 drip tray

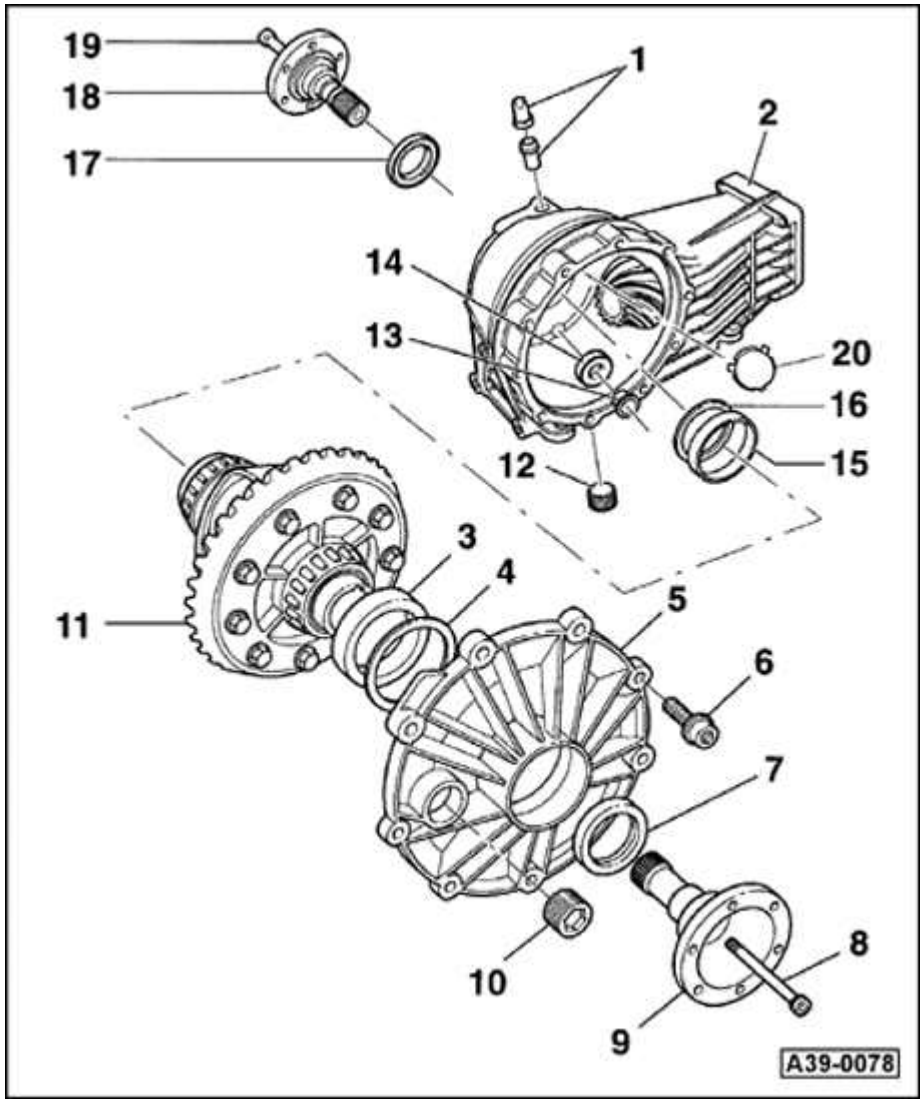
Removing

- Mount final drive on repair stand ⇒ Page 39-110 .
- Place VAG1306 drip tray under final drive and drain gear oil.
- Remove bolts from drive flange housing to final drive housing.



- Remove drive flange housing by pulling on drive flange, and support drive flange housing.

39-112



Differential, removing and installing

Note:

- *General repair instructions* ⇒ *Page 00-11* .
- *Secure final drive on a repair stand* ⇒ *Page 39-108* .
- *Adjustments are required when replacing components marked 1)* ⇒ *Page 39-150* , *Adjustment overview*

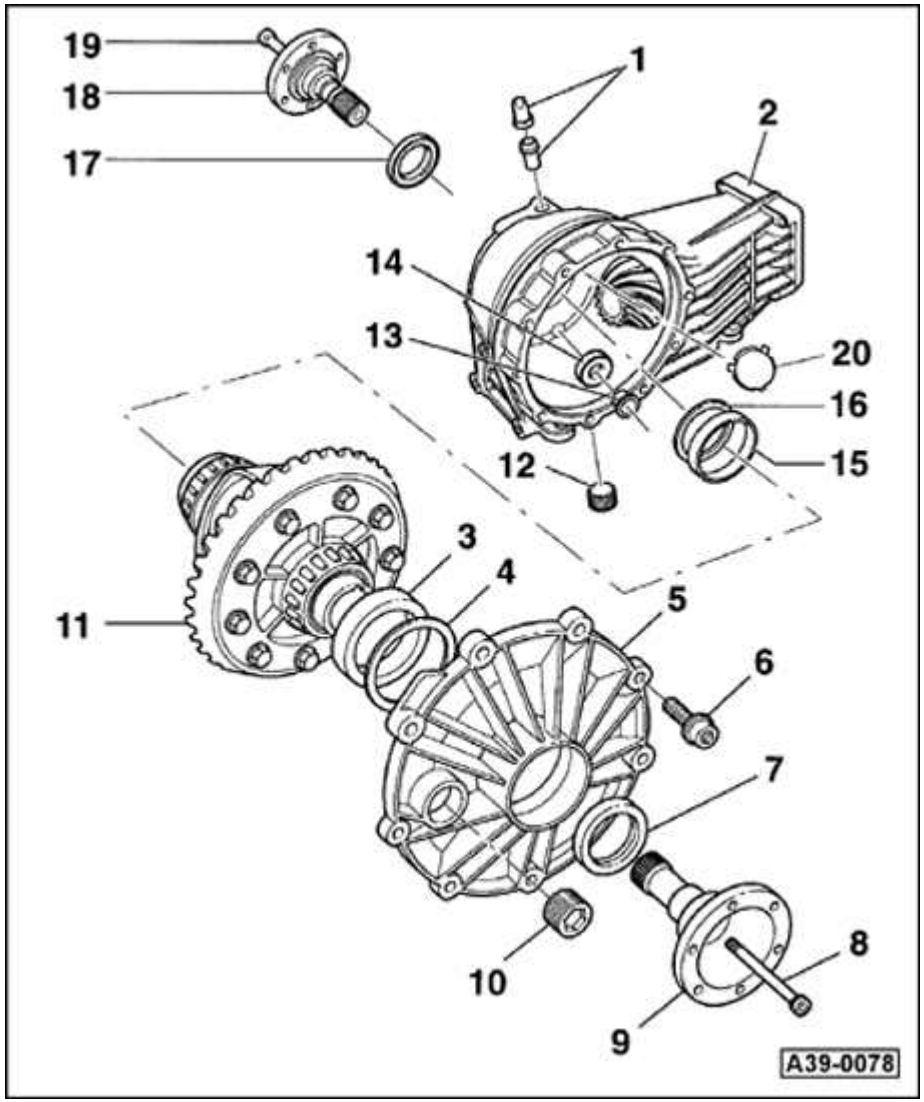
1 - Breather sleeve

- With rubber valve
- Installation position ⇒ Fig. 3

2 - Final drive housing 1)

- With drive pinion
- Removing and installing drive pinion ⇒ Page 39-134

39-113



3 - Outer race for large tapered roller bearing 1)

- Driving out ⇒ *Fig. 7* , ⇒ Page 39-129
- Driving in ⇒ *Fig. 8* , ⇒ Page 39-130

4 - Shim "S1"

- Note thickness
- Adjustment overview ⇒ Page 39-150

5 - Cover for final drive 1)

- With seal
- Replace O-ring
- Lubricate O-ring with oil when installing

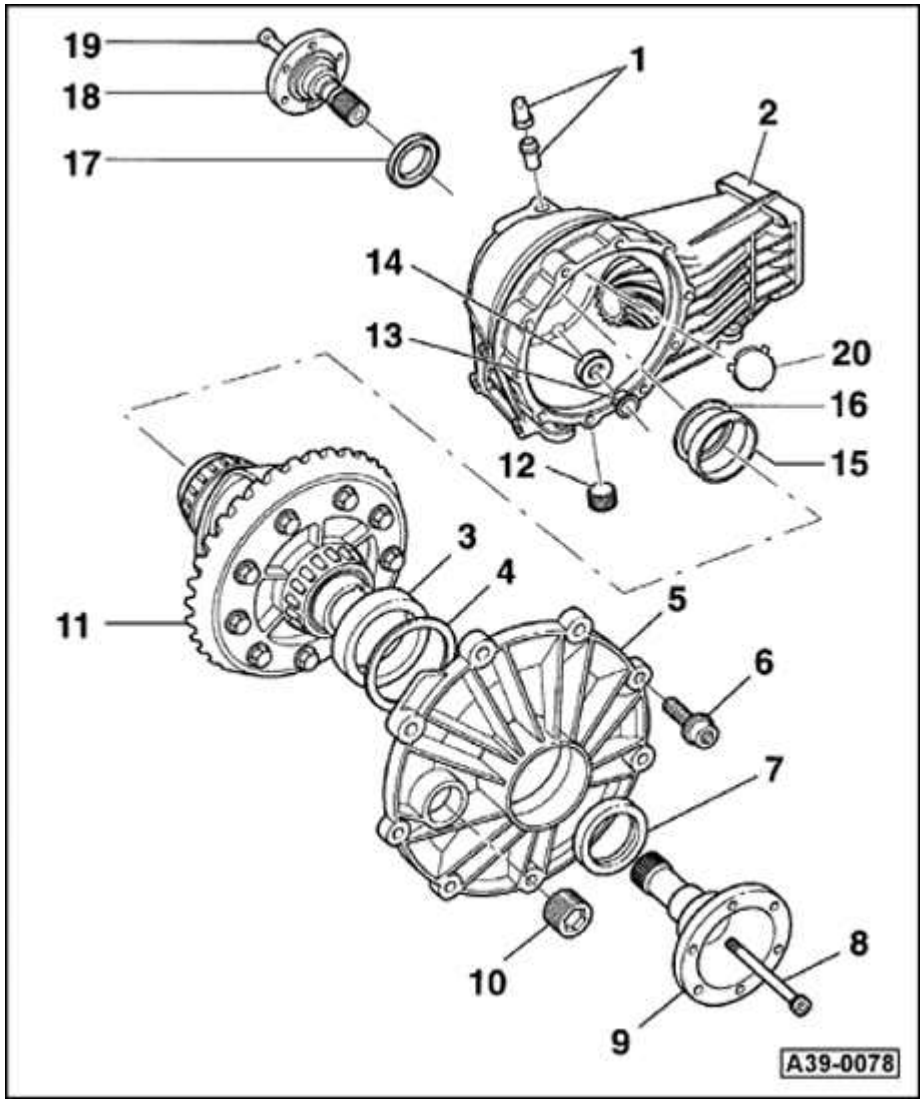
6 - Torx bolt, 25 Nm

7 - Seal, right

- Replacing ⇒ Page 39-98

8 - Hex socket head bolt, 25 Nm

39-114



9 - Drive flange, right

- Removing and installing ⇒ Fig. 1

10 - Oil filler plug, 35 Nm

11 - Differential with ring gear 1)

- Disassembling and assembling ⇒ Page 39-120

12 - Oil drain plug, 35 Nm

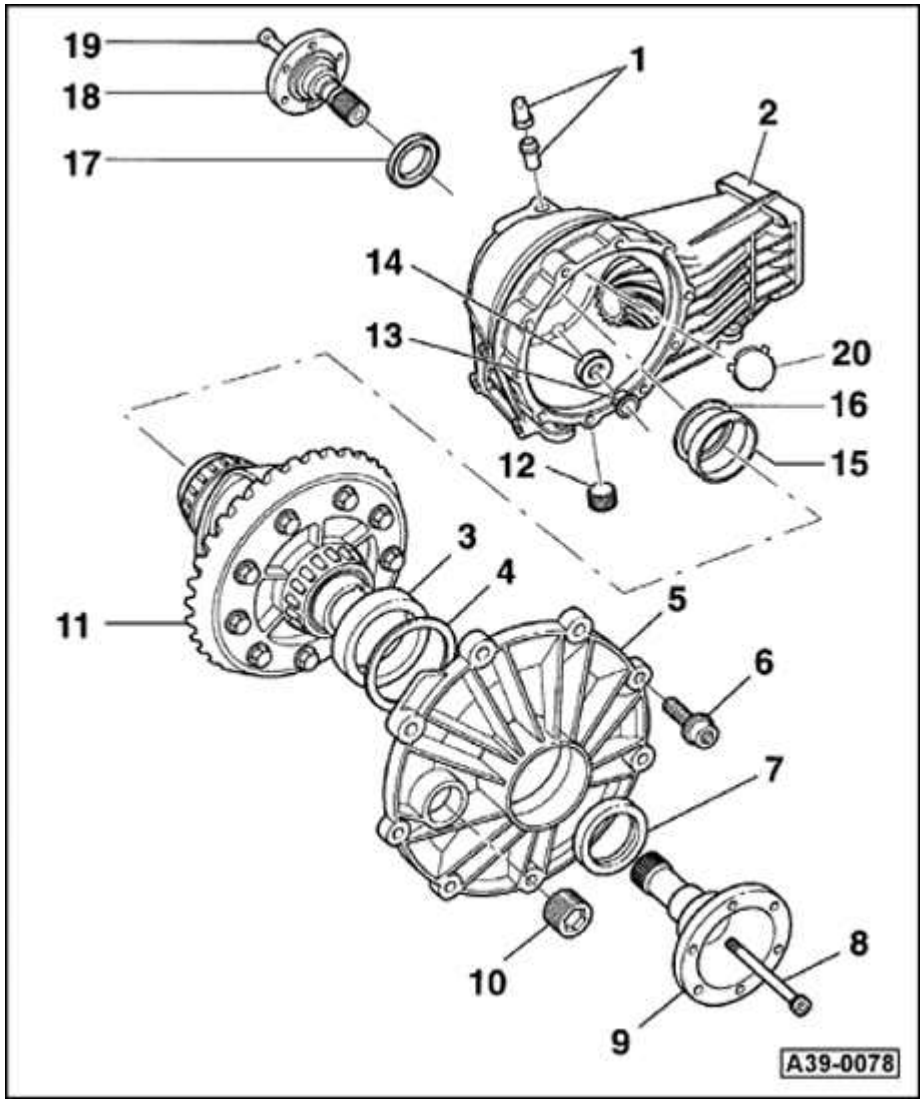
13 - Bushing

- Holds magnet in position
- Knock in onto stop

14 - Magnet

15 - Outer race for small tapered roller bearing 1)

- Knocking out ⇒ *Fig. 1* , ⇒ Page 39-126
- Pressing in ⇒ *Fig. 2* , ⇒ Page 39-126



16 - Shim "S2"

- Note thickness
- Adjustment overview ⇒ Page 39-150

17 - Seal, left

- Replacing ⇒ Page 39-98

18 - Drive flange, left

- Removing and installing ⇒ Fig. 1

19 - Hex socket head bolt, 25 Nm

20 - Cover

- Installing ⇒ Fig. 2

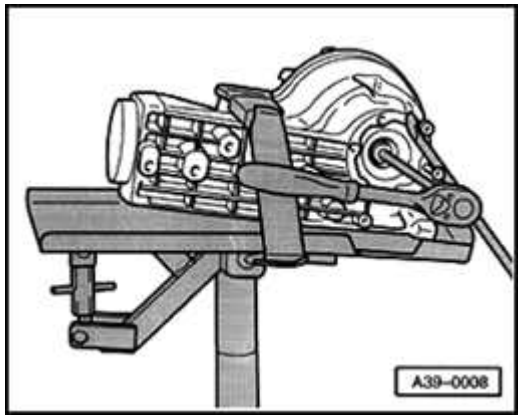


Fig. 1 Removing and installing drive flange

- To loosen securing bolt, screw two bolts into drive flange and counter-hold with a lever.
- Pull out drive flange using bolts already screwed in.

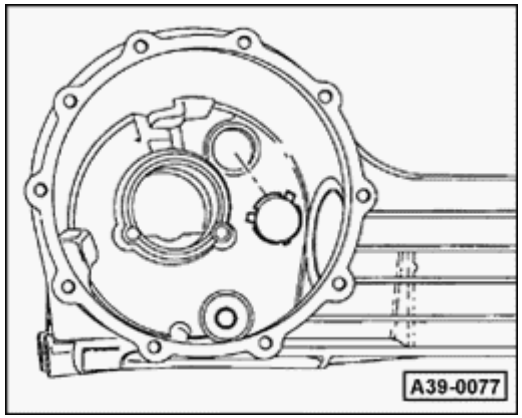


Fig. 2 Pressing cover onto stop

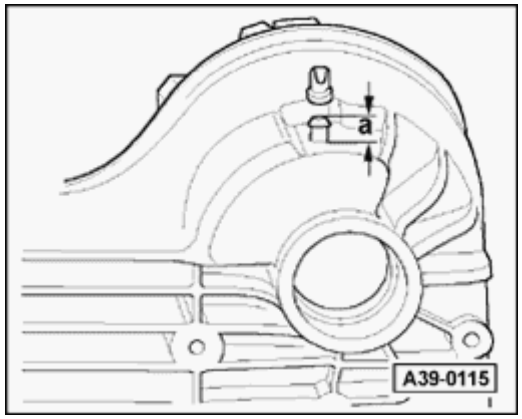


Fig. 3 Position of breather sleeve

The breather sleeve should project 13 mm (distance "a") out of the housing after pressing in.

The slot in the rubber valve should be in line with the direction of travel.

39-118

Removing and installing differential

- Rear final drive removed

Special tools, testers and auxiliary items

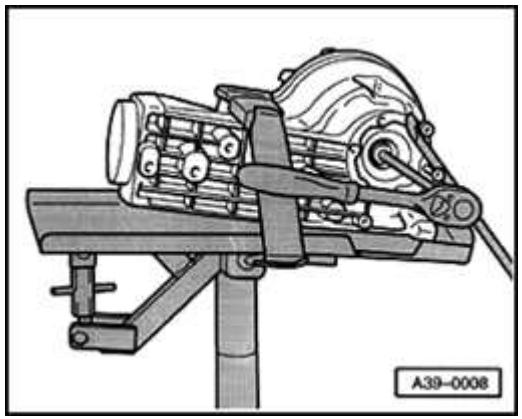
- Drip tray V.A.G 1306

Removing

- Secure complete rear final drive on a repair stand ⇒ Page 39-108 .

- Place drip tray V.A.G 1306 underneath and drain oil.

- Fill space between sealing lip and dust lip with sealing grease G52 128 A1.

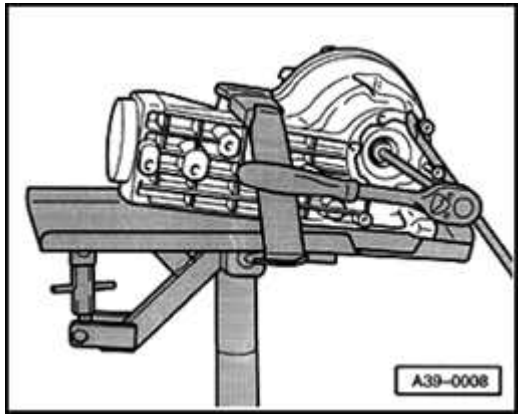


- Remove left and right-hand drive flanges.
- To loosen securing bolt, screw two bolts into drive flange and counter-hold with a lever.
- Mark drive flanges (for left and right sides).
- Pull out drive flange using the bolts already screwed in.
- Unscrew securing bolts from cover for final drive.
- Take cover for final drive off axle housing and remove differential.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Insert differential.
- Replace O-ring for cover for final drive and oil when installing.
- Fit cover for final drive on final drive housing and tighten in diagonal sequence to 25 Nm.
- Replace drive flange oil seals ⇒ Page 39-98 .
- Fill space between sealing and dust lips with sealing grease G52 128 A1.

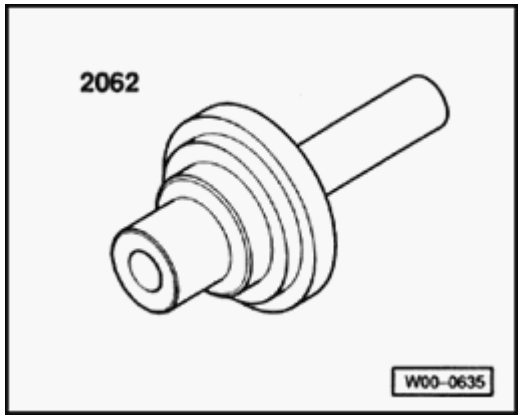


- Install drive flanges and tighten to 25 Nm.
- Top-up gear oil in rear final drive and check oil level ⇒ Page 39-80 .

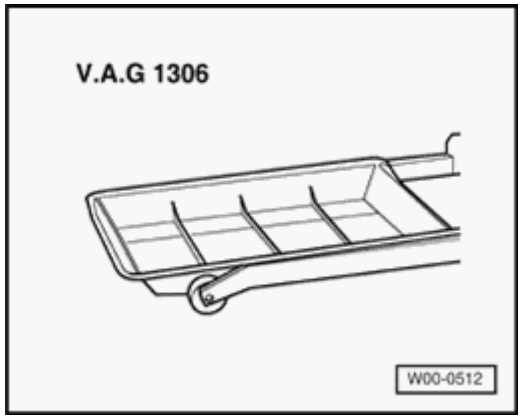
39-113

Oil seals for flange shafts, replacing

Special tools and equipment

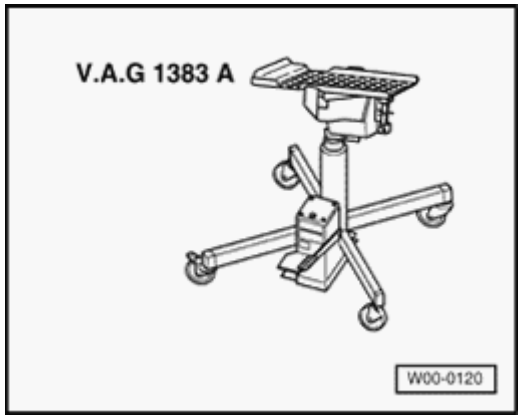


- 2062 driver



- VAG1306 drip tray

39-114



- VAG1383A engine/transmission hoist

Removing

- Rear final drive installed

- Observe general repair notes ⇒ page 00-27 .

Note:

The exhaust system must only be removed if left seal is replaced.

- Remove rear part of exhaust system behind clamping sleeve(s):

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

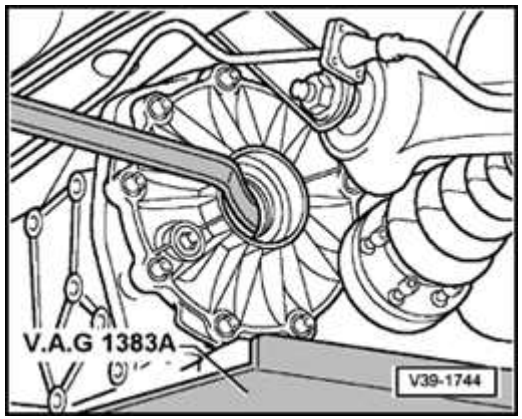
- Remove left or right drive axles from rear final drive and lay to side:

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42; Component allocation of rear axle (All Wheel Drive (AWD) vehicles); Drive axle, removing and installing*

- Remove drive flange. To loosen securing bolt, thread 2 bolts into drive flange and counter hold using tire iron.

- Place VAG1306 drip tray underneath and drain gear oil.

- Remove drive flange at installed bolts.

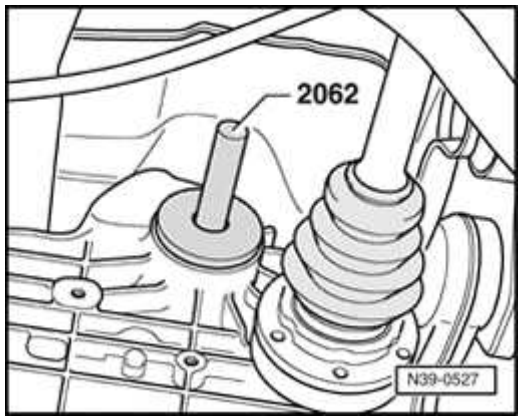


- Pry out drive flange seal using tire iron.

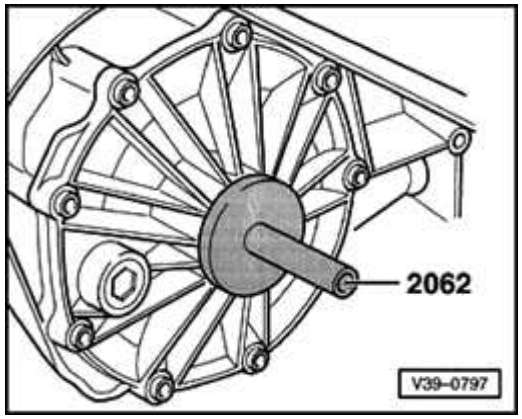
Installing

Installation is reverse of removal, noting the following:

- Clean gasket seat.
- Coat outer edge of oil seal with gear oil.
- Fill gap between sealing lip and dust lip with multi-purpose grease.



- Using 2062 driver, press in seal for left drive flange to stop without bending seal.



- Using 2062 driver, press in seal for right drive flange to stop without bending seal.
- Install driveshaft.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42; Component allocation of rear axle (All Wheel Drive (AWD) vehicles); Drive axle, removing and installing*

- Install exhaust system free of stress:

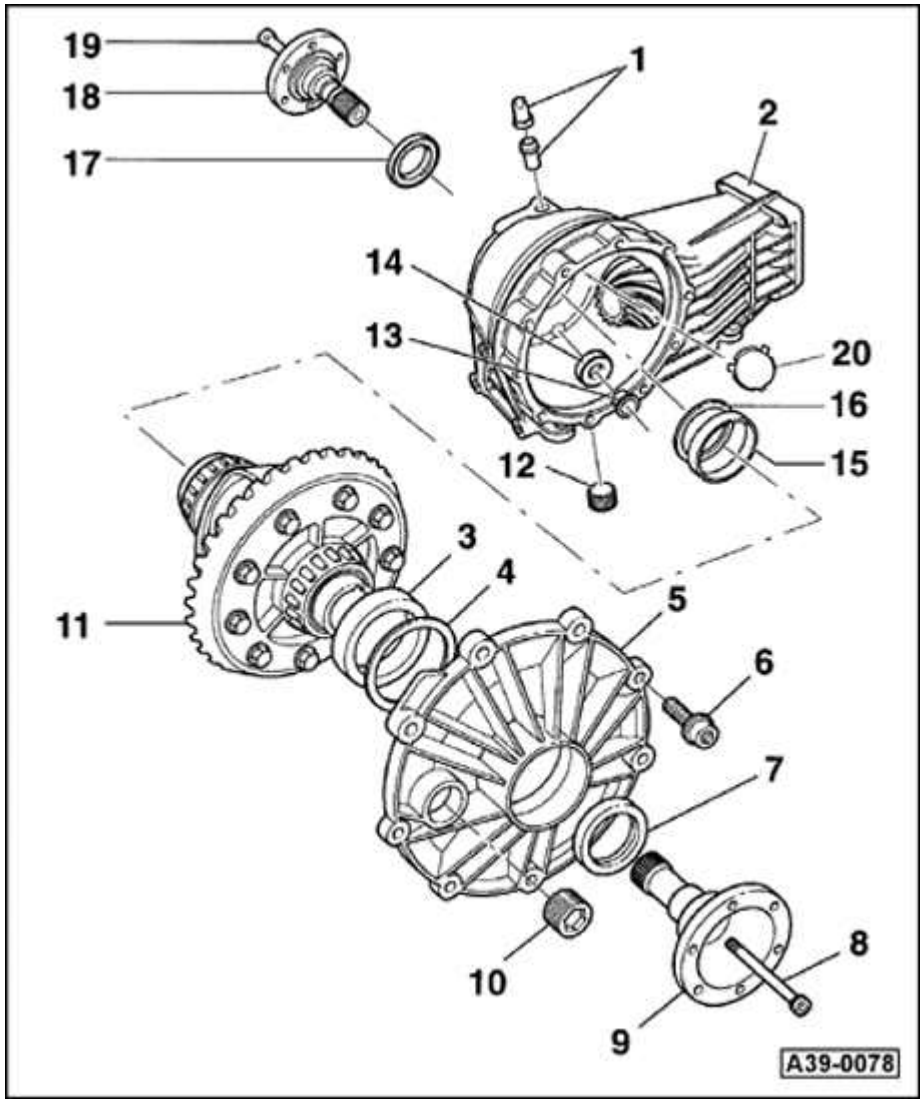
⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Top-up and check gear oil in rear final drive ⇒ page 39-94 .

Tightening torque

Component	Nm
Drive flange to final drive	25

39-114



Differential, removing and installing

Notes:

- *Refer to general repair instructions ⇒ Page 00-14 .*
- *Mounting final drive to repair stand ⇒ Page 39-110 .*
- *Adjustments are required when replacing components marked with 1) ⇒ List of adjustments, ⇒ Page 39-149 .*

1 - Breather sleeve

- With rubber valve
- Installation position ⇒ Fig. 3

2 - Final drive housing1)

- With pinion shaft
- Removing and installing drive pinion ⇒ Page 39-134

3 - Large tapered roller bearing outer race1)

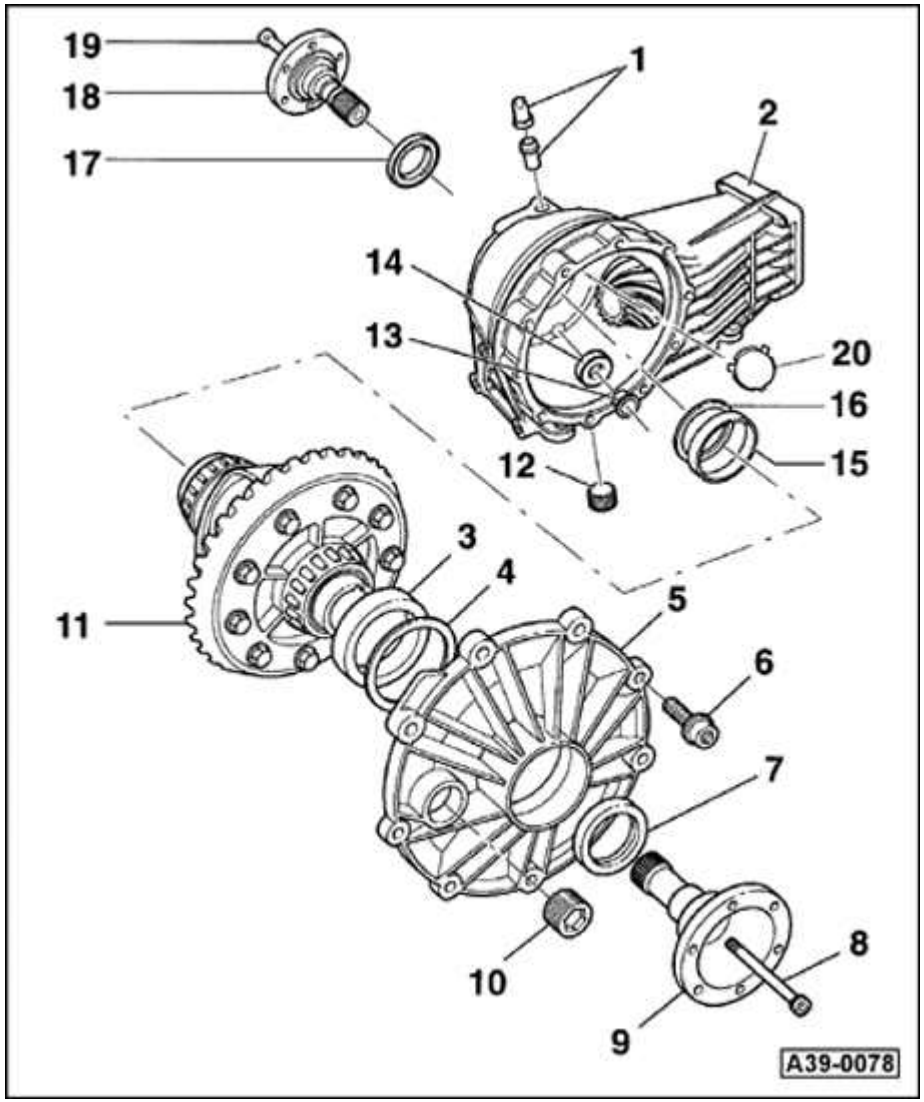
- Removing ⇒ Page 39-129, Fig. 7
- Pressing in ⇒ Page 39-130, Fig. 8

4 - Shim S1

- Note thickness

♦ List of adjustments ⇒ Page 39-149

39-115



5 - Final drive cover1)

- Always replace O-ring
- With O-ring
- Lubricate O-ring with oil when installing

6 - Torx® bolt

- 25 Nm (18 ft lb)

7 - Right seal

- Replacing ⇒ Page 39-100

8 - Socket-head bolt

- 25 Nm (18 ft lb)

9 - Drive flange, right

- Removing and installing ⇒ Fig. 1

10 - Oil filler plug

- 35 Nm (26 ft lb)

11 - Differential with ring gear1)

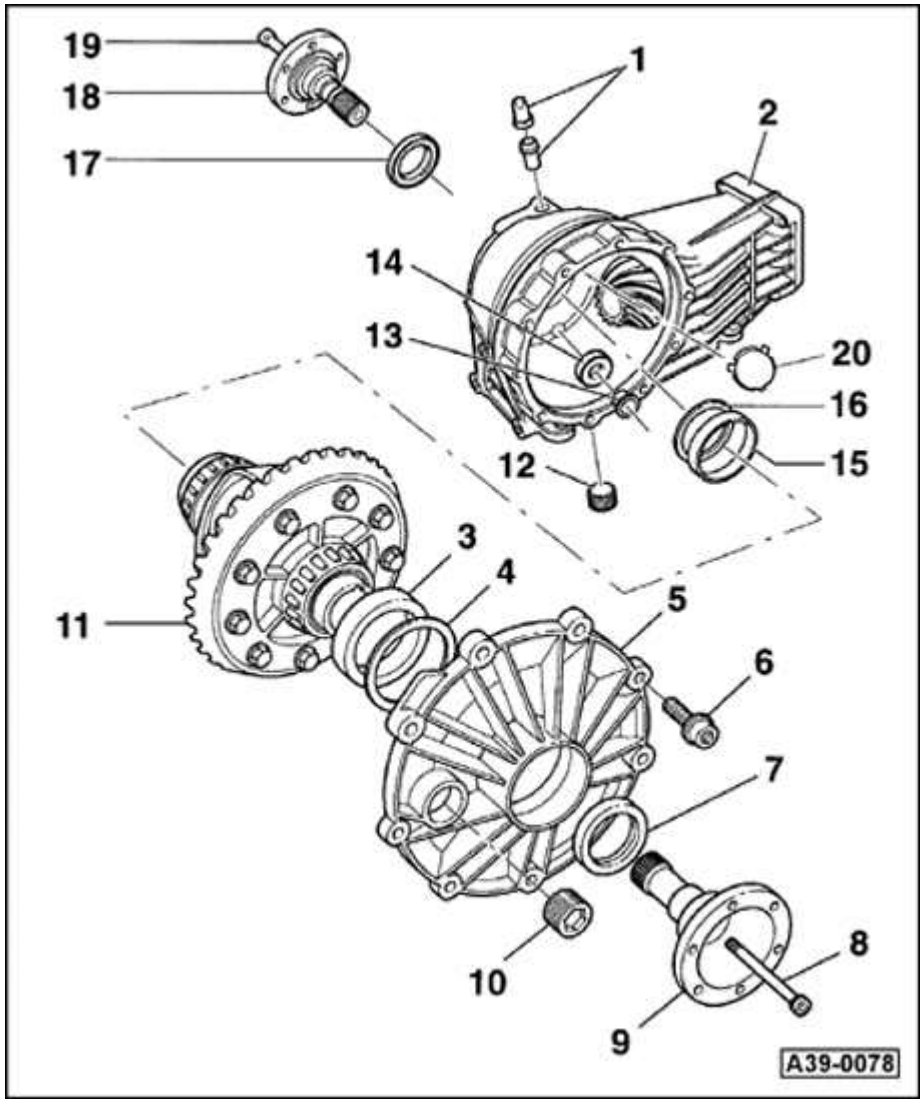
- Disassembling and assembling ⇒ Page 39-121

12 - Oil drain plug

- 35 Nm (26 ft lb)

13 - Bushing

- Holds magnet in position
- Drive in onto stop



14 - Magnet

15 - Small tapered roller bearing outer race 1)

- Removing ⇒ Page 39-126, Fig. 1
- Installing ⇒ Fig. 2, Page 39-126

16 - Shim S2

- Note thickness
- List of adjustments ⇒ Page 39-149

17 - Left seal

- Replacing ⇒ Page 39-100

18 - Drive flange, left

- Removing and installing ⇒ Fig. 1

19 - Socket-head bolt

- 25 Nm (18 ft lb)

20 - Cover

- Installing ⇒ Fig. 2

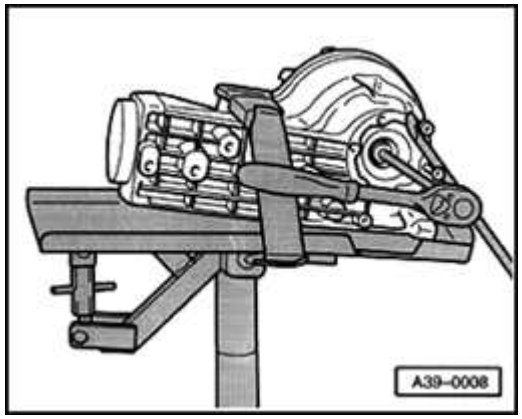


Fig. 1 Removing and installing drive flange

- To loosen mounting bolt, screw in 2 bolts in drive flange and counter-hold using pry bar.
- Pull out drive flange using screwed in bolts.

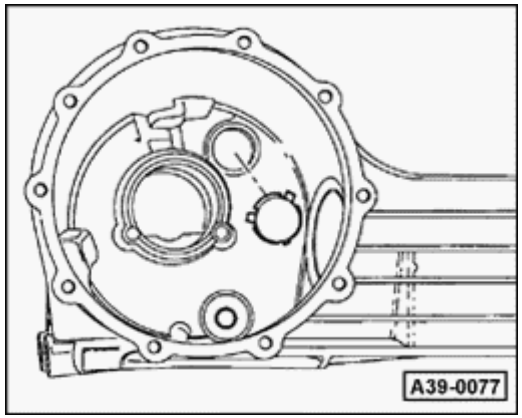


Fig. 2 Press in cover onto stop

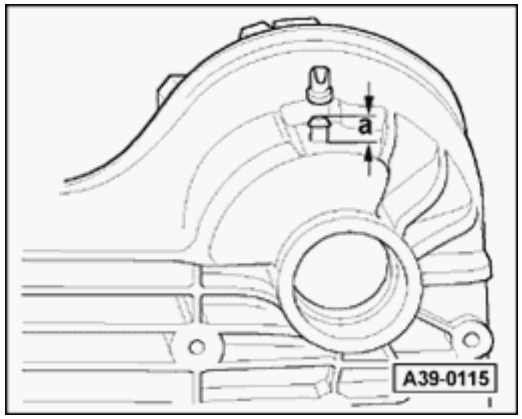


Fig. 3 Position of breather sleeve

The breather sleeve should project 13 mm (0.512 in.) dimension -a- out of final drive housing after pressing in.

The slot in the rubber valve should be in line with the direction of travel.

Removing

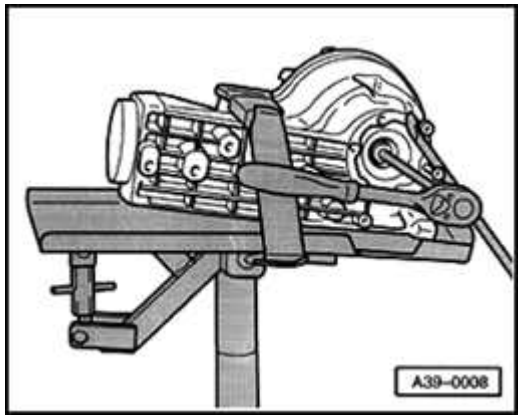
- Final drive removed

Special tools and equipment

VAG1306 drip tray

Secure complete final drive to repair stand using VW540 bracket ⇒ Page 39-110 .

Place drip tray under final drive and drain gear oil.

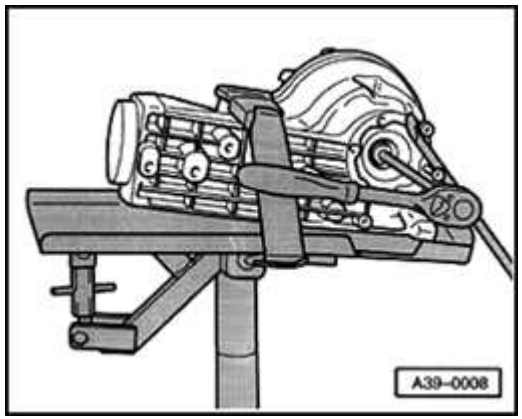


- Remove left and right drive flanges:
- To loosen mounting bolt, screw two bolts into drive flange and counter-hold with pry bar.
- Mark drive flanges (left and right).
- Pull out drive flange using screwed in bolts.
- Remove mounting bolts from final drive cover.
- Remove final drive cover from final drive housing and remove differential.

Installing

Install in reverse order of removal, note the following:

- Install differential.
- Replace O-ring for final drive cover and lubricate before installing.
- Install final drive cover on final drive housing and tighten in diagonal sequence to 25 Nm (18 ft lb).
- Replace seals for drive flange ⇒ Page 39-100 .
- Fill space between sealing lip and dust lip with gear oil

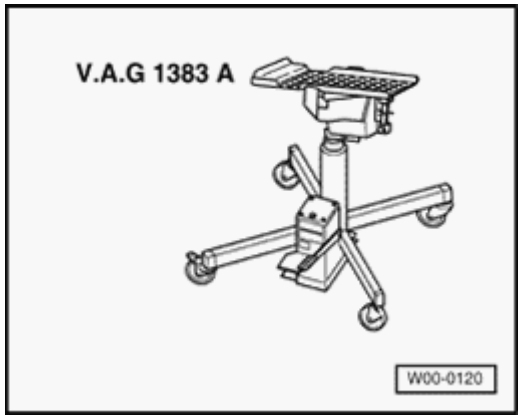


- Install drive flanges and tighten 25 Nm (18 ft lb).
- Top off gear oil in final drive and check oil level ⇒ Page 39-84 .

39-117

Rear final drive, removing and installing

Special tools and equipment



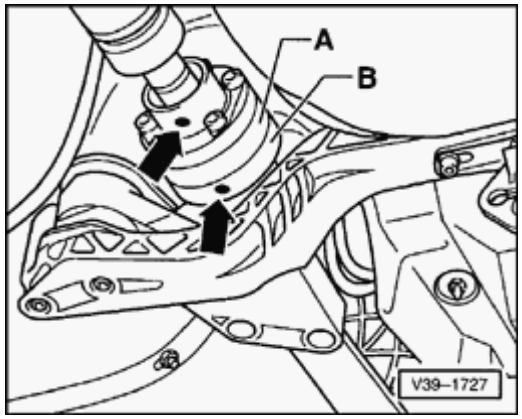
- VAG1383A engine/transmission hoist

Removing

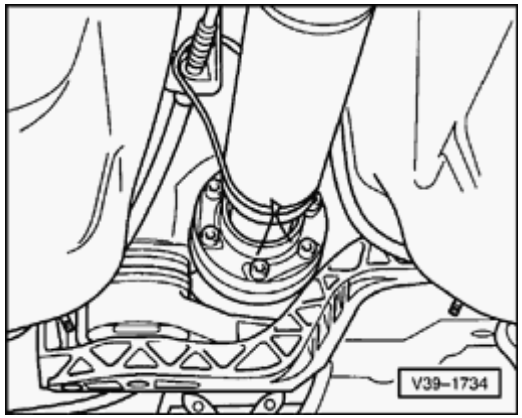
- Remove rear part of exhaust system behind clamping sleeve(s):

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

- Remove heat shields above driveshaft.



- Check whether there is a factory marking (color marking) on the driveshaft. If not, mark location of driveshaft flange -A- to rear final drive -B- with color.
- Remove mounting bolts of driveshaft flange.



- Tie up driveshaft at mount for parking brake cable using wire.

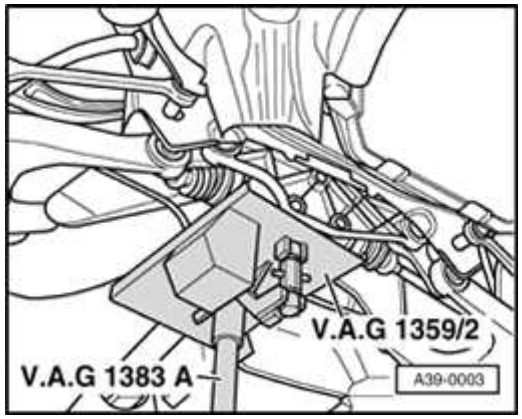
Note:

If the driveshaft cannot be pressed upward past the flange, tie up driveshaft after lowering final drive. When lowering, secure driveshaft against falling down and note permissible bending angle of driveshaft ⇒ Notes ⇒ page 39-73 .

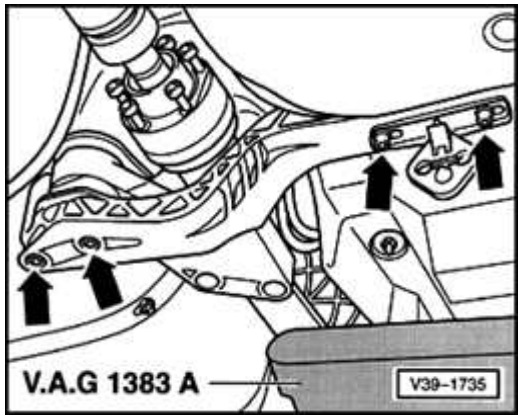
- Loosen left or right drive axle from rear final drive

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 42; Component allocation of rear axle (All Wheel Drive (AWD) vehicles); Drive axle, removing and installing*

39-119

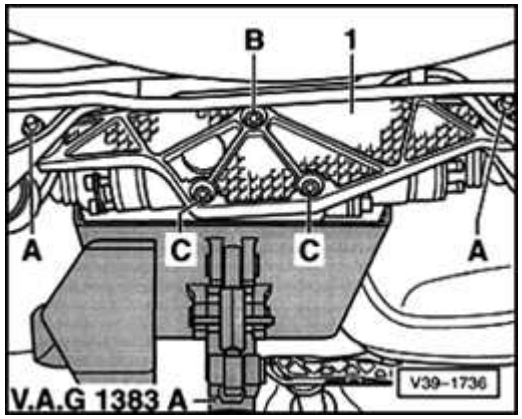


- Support final drive with VAG1383A transmission hoist and VAG1359/2 universal mount.
- Secure final drive using belt.



- Remove bolts (arrows) at front crossmember for rear final drive.
- Remove front crossmember.

39-120



- Remove securing bolts -B- and -C- of rear crossmember at rear final drive.
- Lower final drive using transmission hoist.

Note:

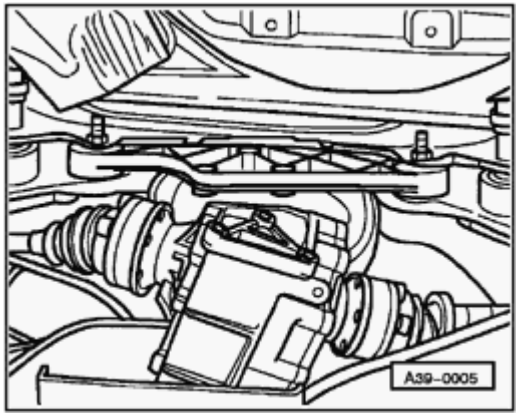
Crossmember -1- does not have to be removed.

Installing

Installation is reverse of removal, noting the following:

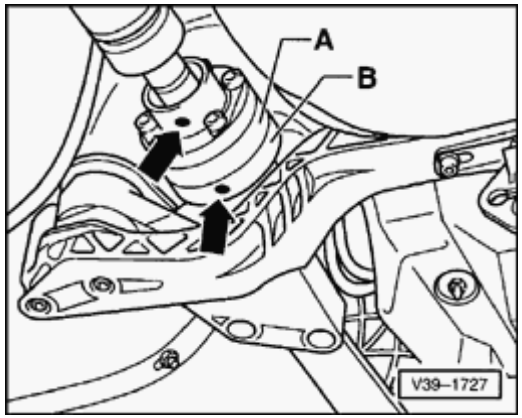
Notes:

- *Always replace self-locking nuts.*
- *Always clean any remaining locking fluid from thread for drive flange on rear final drive after removing driveshaft. Otherwise there is a risk that the bolts may become cross-threaded when installed and shear when removed again.*
- *Cleaning can be performed with a tap.*
- *Always replace seal between drive flange and driveshaft (remove protective film and attach seal to drive flange). Adhesive surface must be free of grease.*
- *Replace driveshaft bolts (self-locking).*



- Using transmission hoist, lift up final drive until both drive axles can be flanged on.
- Lightly tighten drive axle securing bolts.
- Lift final drive and bolt to crossmember and final drive mount.
- Bolting in driveshaft ⇒ page 39-83 .

Notes:



- *To prevent imbalance, driveshaft flanges -A- and rear final drive flanges -B- must be installed so that the color markings are aligned (arrows).*
- *After disconnecting driveshaft from rear final drive, an additional balance washer (thick washer) that may be located between shim and bolt head may not be reinstalled.*
- *Replace driveshaft bolts (self-locking).*
- Checking gear oil in rear final drive ⇒ page 39-94 .
- Install exhaust system free of stress:

⇒ *Repair Manual, Engine Mechanical, Repair Group 26; removing and installing exhaust system*

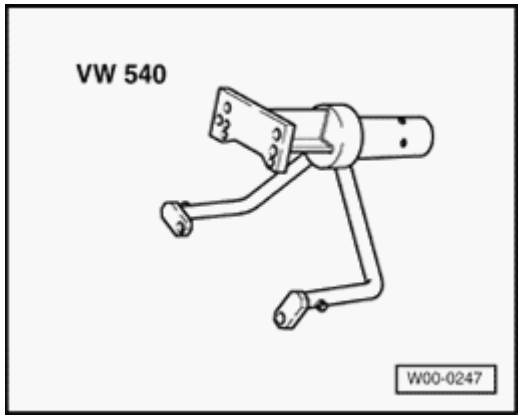
Tightening torques

Component		Nm
Driveshaft to final drive (Input flange)		55
Front crossmember for rear final drive to body		40
Front crossmember for rear final drive with exhaust system bracket to body		23
Rear crossmember for rear final drive to subframe		50
Rear final drive to rear crossmember		55
Driveshaft to drive flange	M8	40
	M10	77

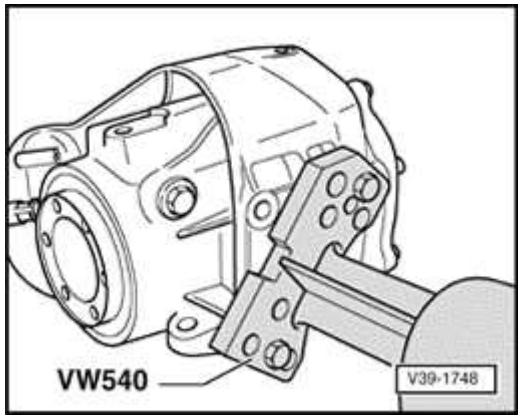
39-123

Rear final drive, securing to assembly fixture

Special tools and equipment



- VW540 holding fixture



- Secure complete rear final drive to assembly fixture using VW540 holding fixture.

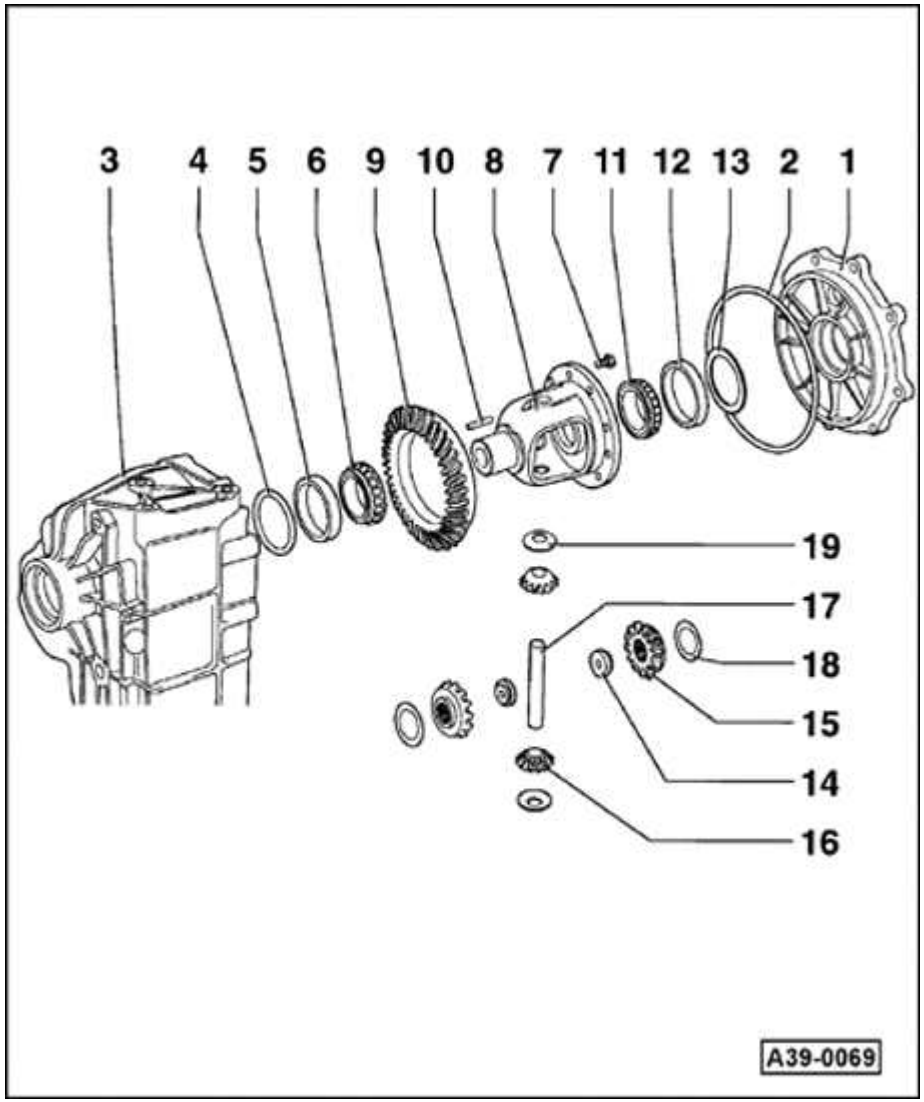
Differential, disassembling and assembling

Special tools, testers and auxiliary items

- Drift VW 295
- Press plate VW 401
- Press plate VW 402
- Press tool VW 407
- Press tool VW 408 A
- Press tool VW 412
- Press tool VW 442
- Press tool 40-21
- Thrust plate 40-105
- Thrust pad 2050

- Drift 3138
- Tapered roller bearing puller V.A.G 1582 and V.A.G 1582/6
- Two-arm puller Kukko 44/2

39-121



Note:

- *General repair instructions* ⇒ *Page 00-11* .
- *Replace both tapered roller bearings of the differential together. Use same make if possible.*
- *Adjustments are required when replacing components marked 1)* ⇒ *Page 39-150* , *Adjustment overview*

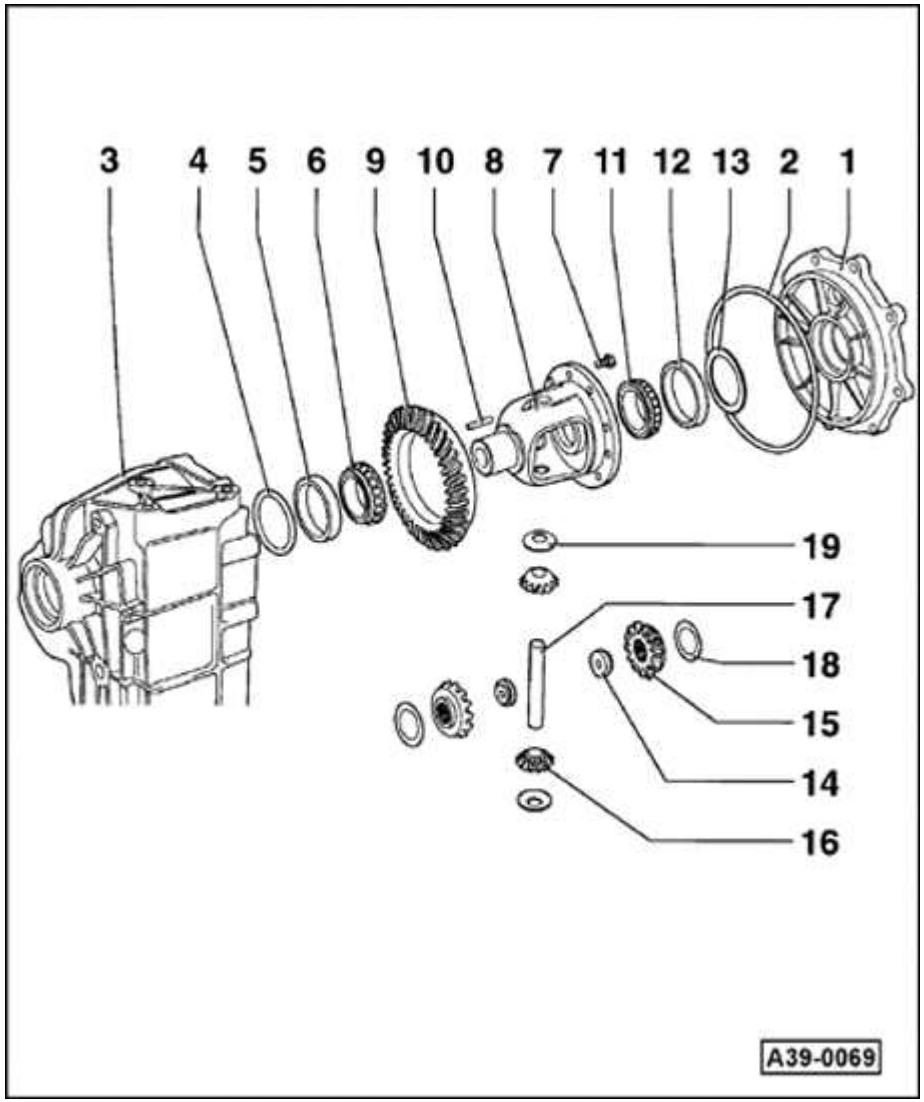
1 - Cover for final drive 1)

2 - O-ring

- Always replace
- Insert with oil

3 - Final drive housing 1)

39-122



4 - Shim "S2"

- Note thickness
- Adjustment overview ⇒ Page 39-150

5 - Outer race for small tapered roller bearing 1)

- Knocking out ⇒ Fig. 1
- Pressing in ⇒ Fig. 2

6 - Inner race for small tapered roller bearing 1)

- Pulling out ⇒ Fig. 3
- Pressing in ⇒ Fig. 4

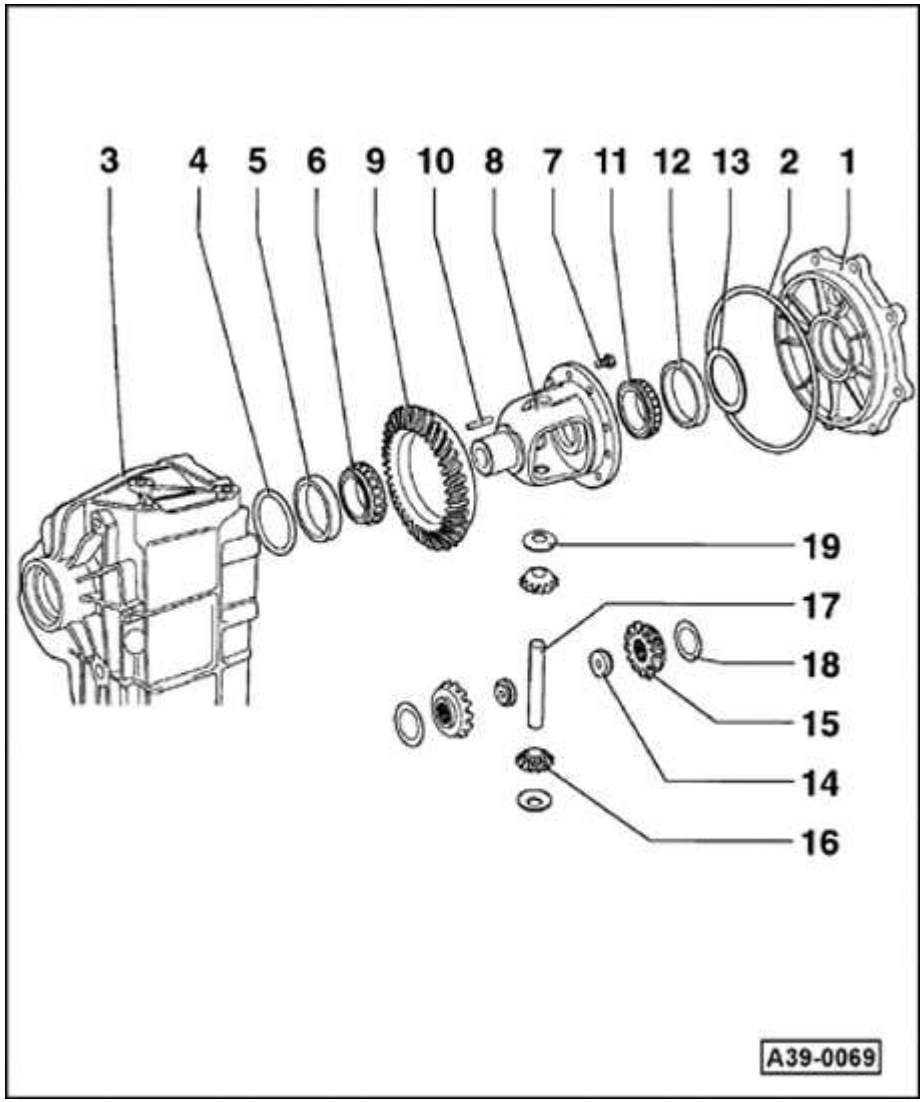
7 - Bolt, 60 Nm + turn 45° further

- Always replace
- Allocation

⇒ *Parts catalog*

- Lightly tighten bolts then tighten diagonally to correct torque

39-123



8 - Differential housing [1)]

9 - Ring gear [1)]

- Paired with drive pinion (final drive set)
- Select correct version according to code letters

⇒ *Parts catalog*

- Drive off housing with a punch ⇒ Fig. 9
- Installing on differential housing ⇒ Fig. 10

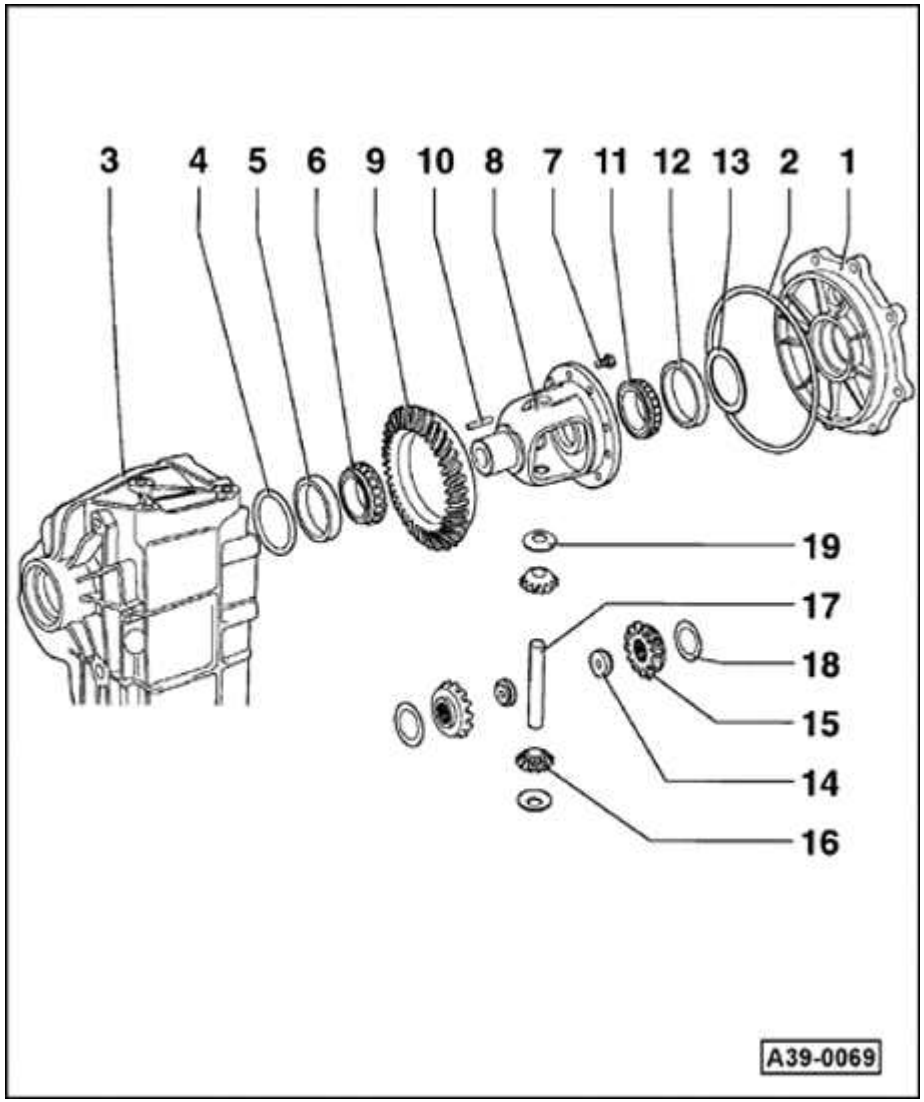
10 - Spring pin

- For securing planet pinion axis shaft
- Drive in flush

11 - Inner race for large tapered roller bearing [1)]

- Pulling off ⇒ Fig. 5
- Pressing on ⇒ Fig. 6

39-124



12 - Outer race for large tapered roller bearing
1)

- Driving out ⇒ Fig. 7
- Pressing in ⇒ Fig. 8

13 - Shim "S1"

- Note thickness
- Adjustment overview ⇒ Page 39-150

14 - Threaded piece

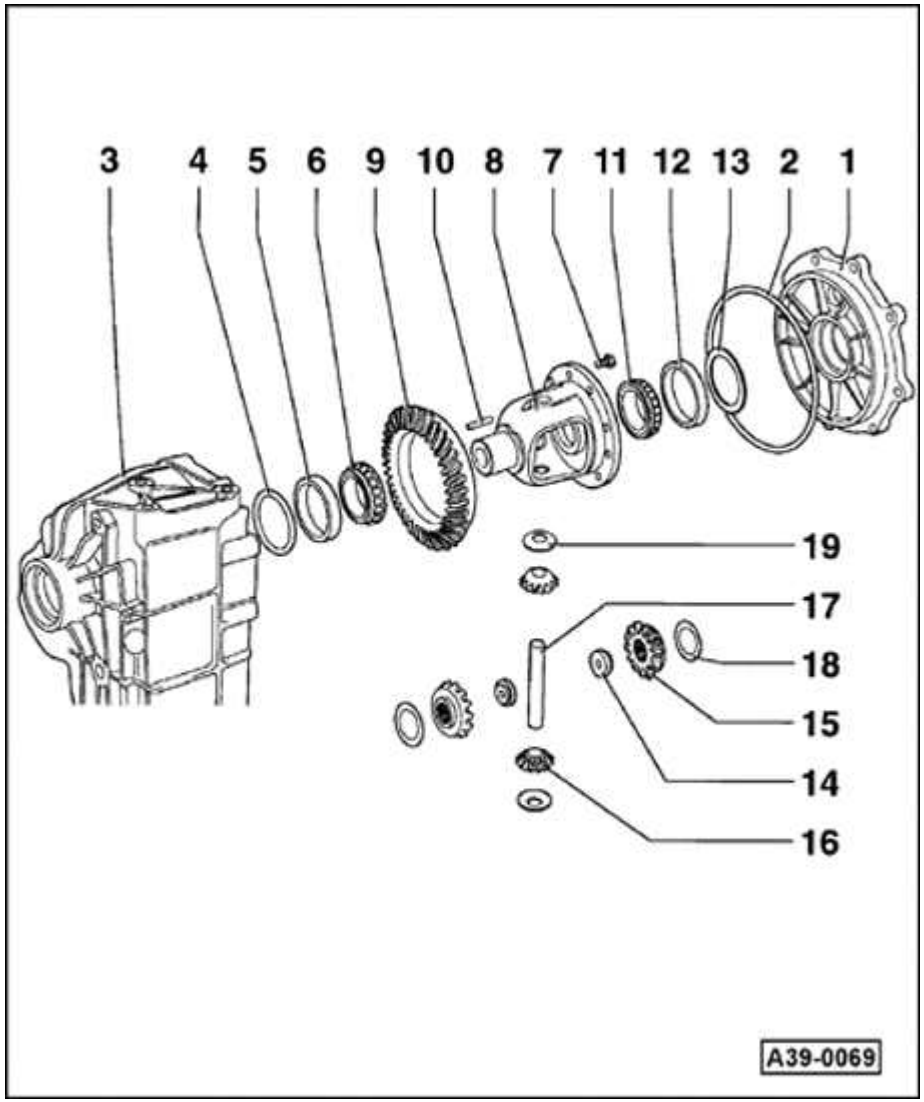
15 - Sun wheel

- Installing ⇒ Fig. 11
- Adjusting ⇒ Fig. 12

16 - Planet pinion

- Installing ⇒ Fig. 11

39-125



17 - Planet pinion axis shaft

- Knock out with drift
- Drive in carefully so that the thrust washers are not damaged
- Secure with spring pin - 10 -

18 - Shim

- Re-determining thickness ⇒ Fig. 12

19 - Thrust washer

- Check for cracks

39-126

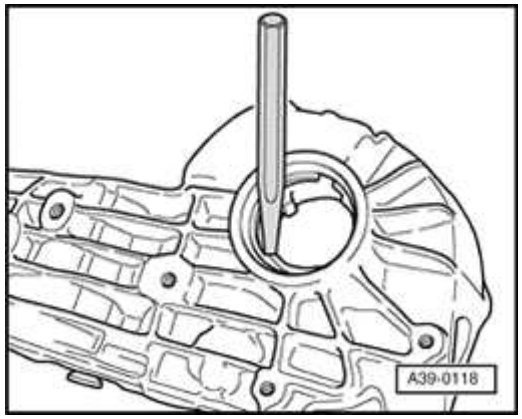


Fig. 1 Knocking outer race of small tapered roller bearing out of housing

- After removing check shims for damage.

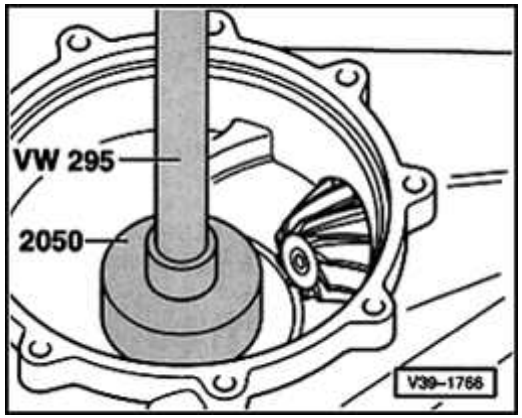


Fig. 2 Pressing outer race of small tapered roller bearing into housing (press against stop)

- Position outer race using VW 295 and light even blows with a hammer.
- Drive in onto stop as shown in illustration.

39-127

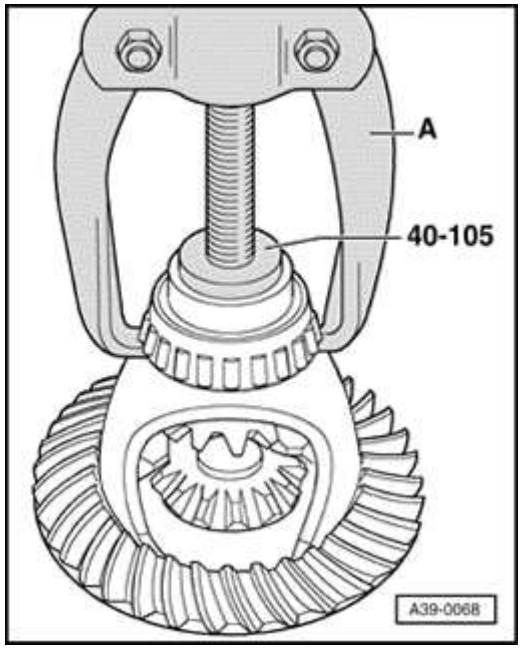


Fig. 3 Pulling off inner race for small tapered roller bearing

A - Two arm puller, e.g. Kukko 44/2

39-128

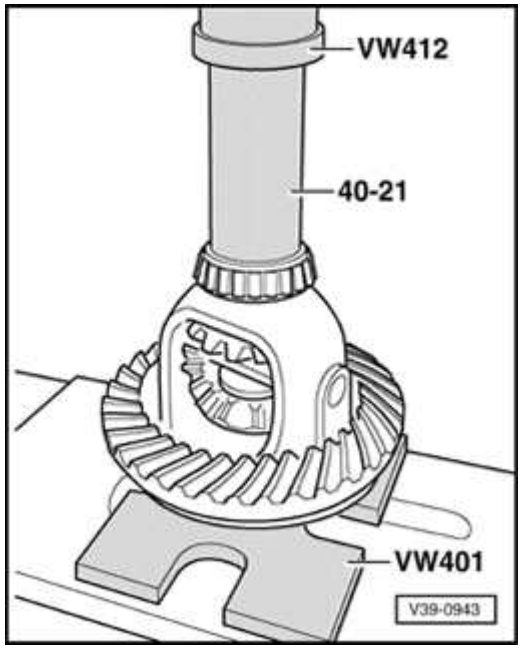


Fig. 4 Pressing on inner race for small tapered roller bearing

CAUTION!

Wear protective gloves.

- Heat bearing to approx. 100 ° C, fit in position and press home.

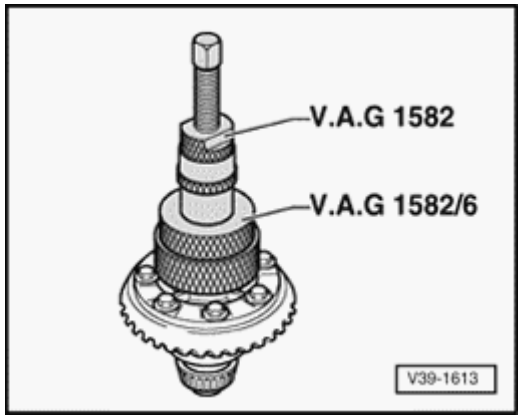


Fig. 5 Pulling off inner race for large tapered roller bearing

- Before fitting extractor position press piece 40-105 on differential housing.

39-129

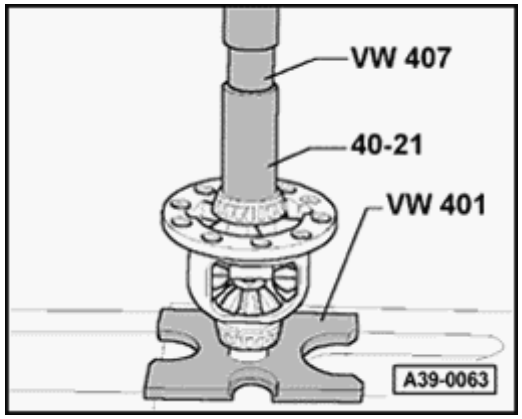


Fig. 6 Pressing on inner race for large tapered roller bearing

CAUTION!

Wear protective gloves.

- Heat bearing to approx. 100 ° C, fit in position and press home.

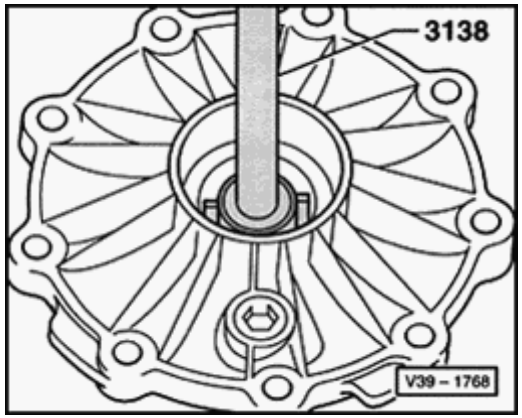


Fig. 7 Driving outer race for large tapered roller bearing out of cover

- After removing check shims for damage.

39-130

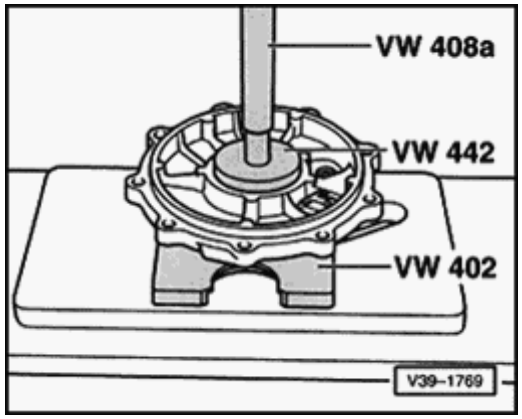


Fig. 8 Pressing outer race for large tapered roller bearing into cover

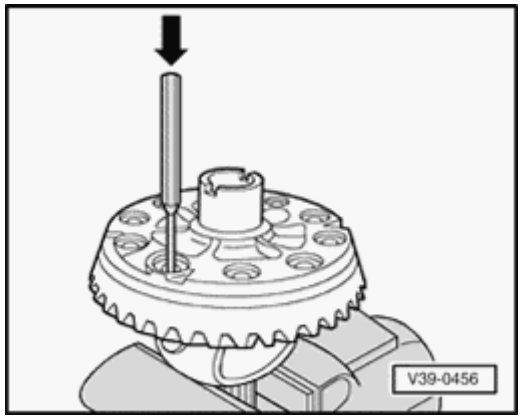


Fig. 9 Driving ring gear off housing

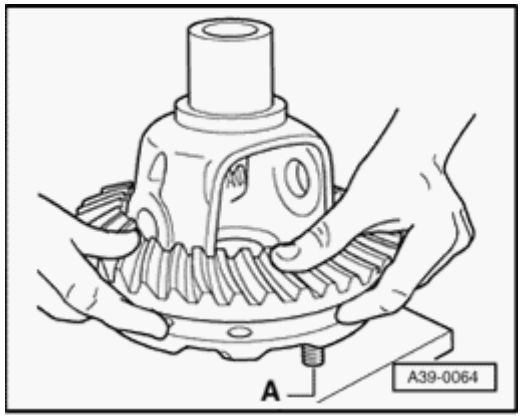


Fig. 10 Installing ring gear

CAUTION!

Wear protective gloves.

- When fitting ring gear guide centralizing pins -A- (local manufacture).
- Heat ring gear to approx. 100 ° C and install.

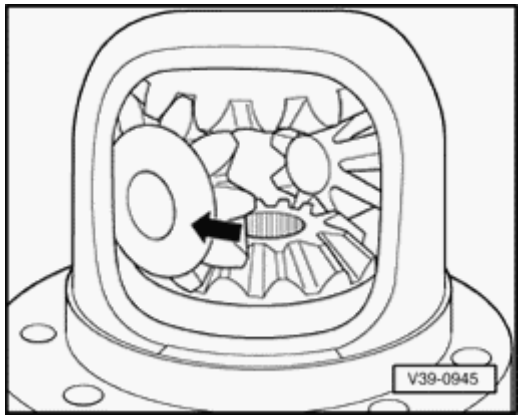


Fig. 11 Installing sun wheels and planet pinions

- If sun wheels have been replaced, measure and select new shims ⇒ Fig. 12 .
- Insert sun wheels with measured shims.
- Install planet pinions spaced 180 ° apart, and rotate into position (arrow).
- Fit and align thrust washers.
- Insert threaded pieces.
- Drive planet pinion shaft into final position and secure.

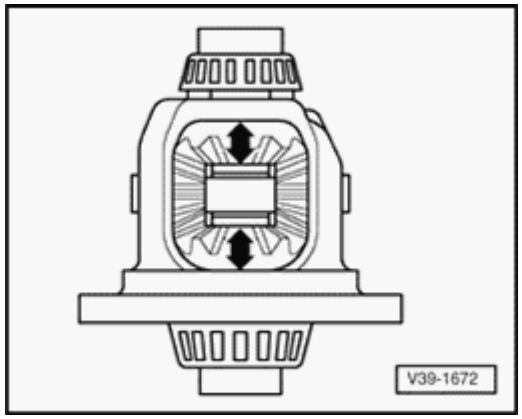


Fig. 12 Adjusting differential bevel gears

- Insert sun wheels with thinnest shims (0.5 mm).
- Insert planet pinions with thrust washers spaced 180° apart.

Note:

Do not now interchange bevel gears and thrust washers.

- Drive in planet pinion axis shaft.
- Press planet pinions outward.
- Press sun wheels in direction indicated (arrows), and check the amount of play.
- Determine thickest shims for sun wheels (on each side) which can still just be inserted.

  The same thickness of shim should be used on both sides.
- Identify shims according to table.

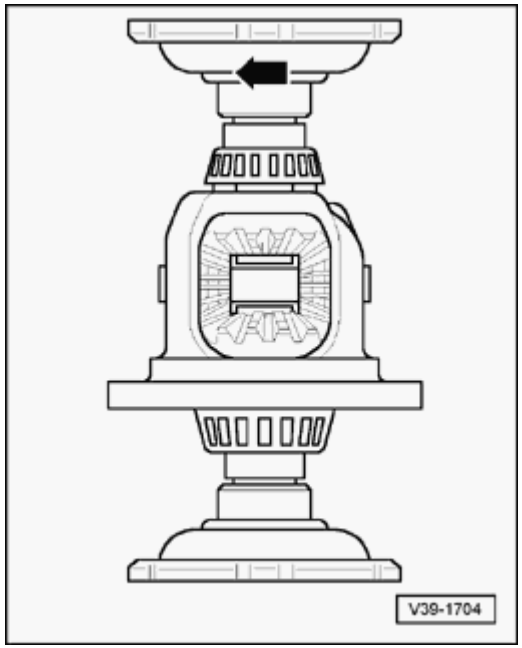
⇒ *Parts catalog*

39-133

The following shims are available:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

Note:



The adjustment is also correct if no further play is perceptible, although it is still possible to rotate the differential bevel gears (arrow).

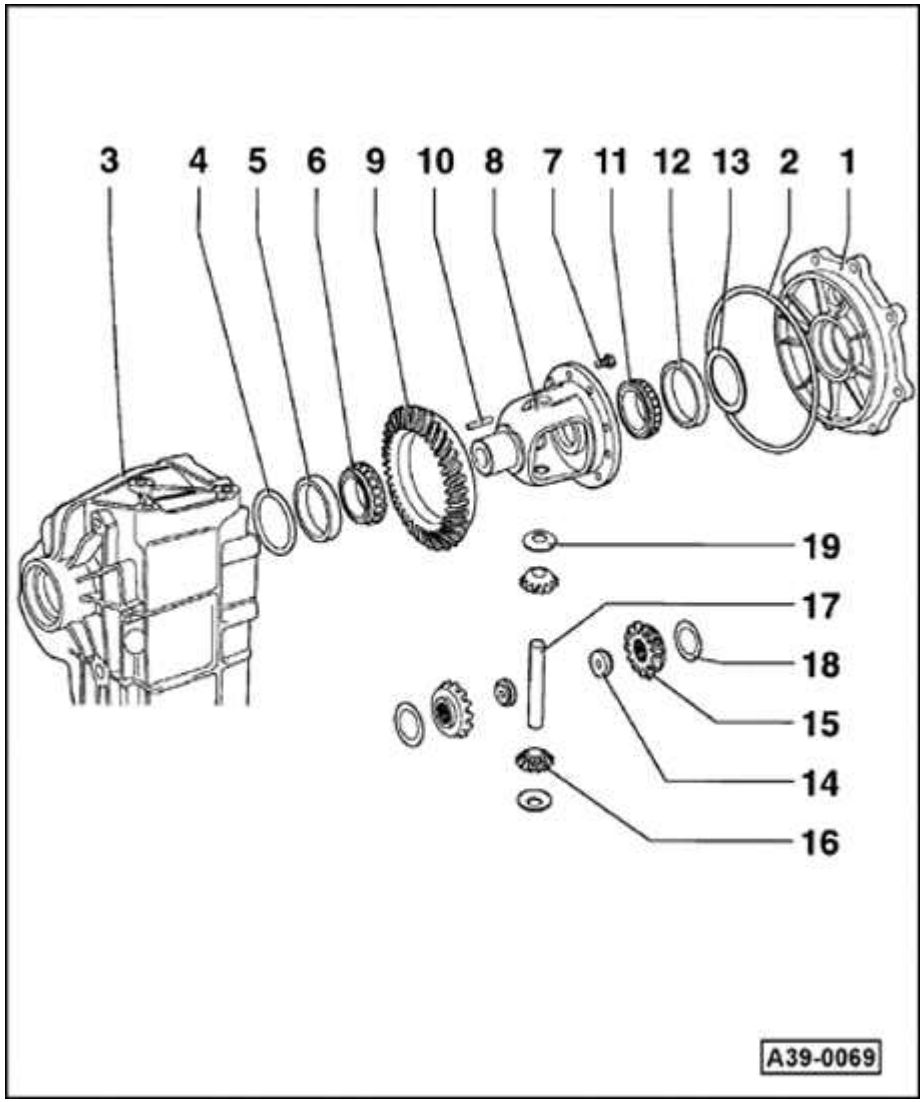
Differential, disassembling and assembling

Special tools and equipment

- VW295 needle bearing drift
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 thrust disc
- VW442 thrust pad
- 40-21 sleeve
- 40-105 thrust piece
- 2050 thrust plate

- 3138 drift
- VAG1582 tapered roller bearing puller with VAG1582/6 attachment
- Kukko 44/2 two arm puller

39-122



Notes:

- *Observe general repair instructions ⇒ Page 00-14 .*
- *Replace both tapered roller bearings together. If possible use same manufacturer.*
- *Adjustments are required when replacing components marked with 1) ⇒ List of adjustments, ⇒ Page 39-149 .*

1 - Cover for final drive1)

2 - O-ring

- Always replace
- Lubricate with oil before installing

3 - Final drive housing1)

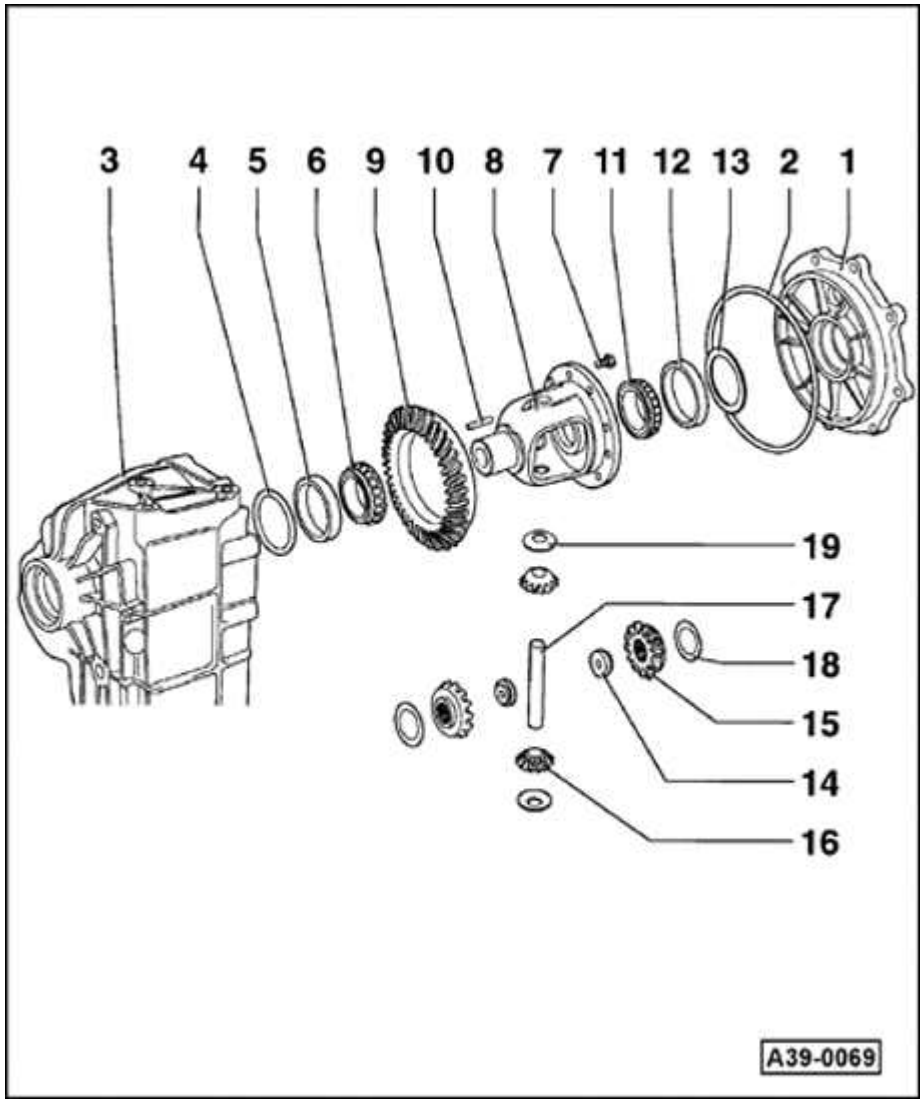
4 - Shim S2

- Note thickness
- List of adjustments ⇒ Page 39-149

5 - Small tapered roller bearing outer race1)

- Removing ⇒ Fig. 1
- Pressing in ⇒ Fig. 2

39-123



6 - Small tapered roller bearing inner race1)

- Removing ⇒ Fig. 3
- Installing ⇒ Fig. 4

7 - Bolt

- Always replace
- Lightly tighten bolts, then tighten diagonally to correct torque
- 60 Nm (44 ft lb) + 1/8 turn (45 °)
- Allocation ⇒ parts catalog

8 - Differential housing1)

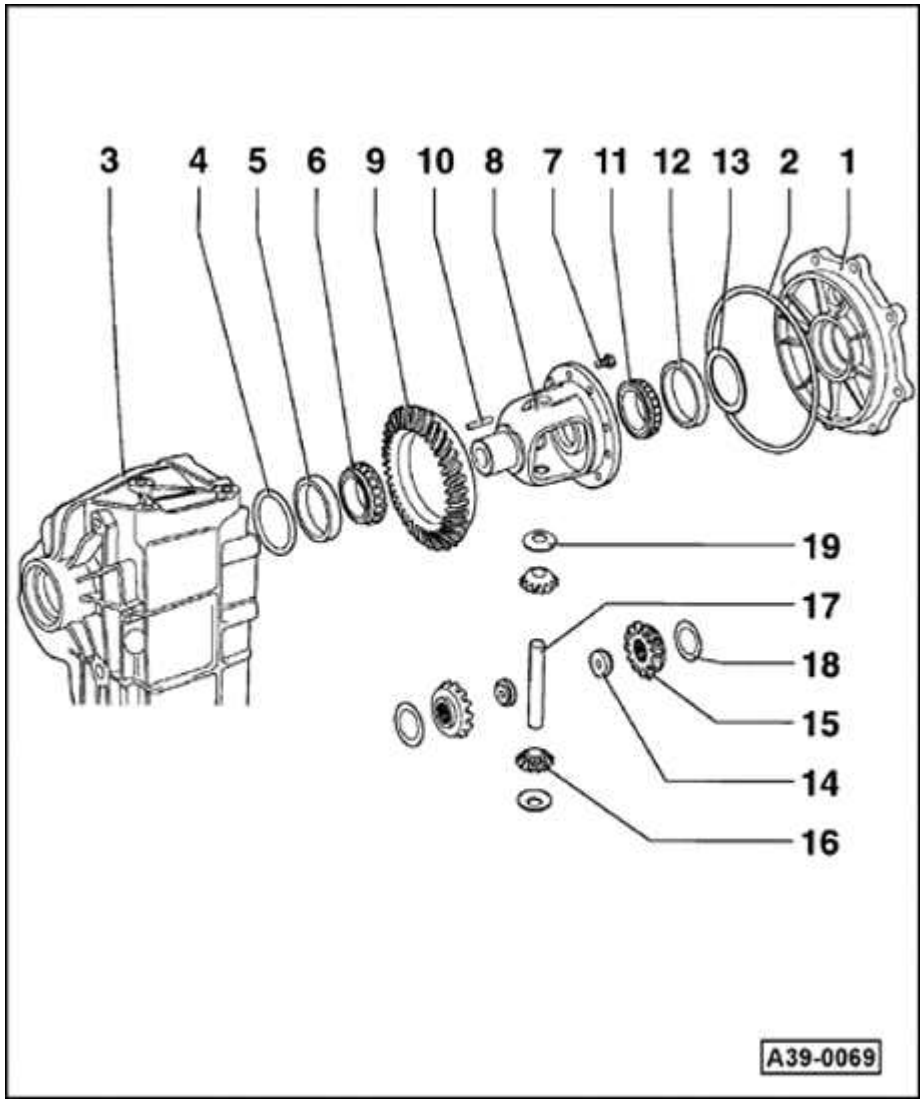
9 - Ring gear1)

- Matched with pinion shaft (in ring gear and pinion set)
- Select correct version according to code letters ⇒ parts catalog
- Remove differential housing using mandrel ⇒ Fig. 9
- Installing on differential housing ⇒ Fig. 10

10 - Roll pin

- For securing differential bevel gear shaft for differential bevel gears
- Drive in flush

39-124



11 - Large tapered roller bearing inner race1)

- Removing ⇒ Fig. 5
- Installing ⇒ Fig. 6

12 - Large tapered roller bearing outer race1)

- Removing ⇒ Fig. 7
- Installing ⇒ Fig. 8

13 - Shim S1

- Note thickness
- List of adjustments ⇒ Page 39-149

14 - Threaded piece

15 - Differential bevel gears, large

- Installing ⇒ Fig. 11
- Adjusting ⇒ Fig. 12

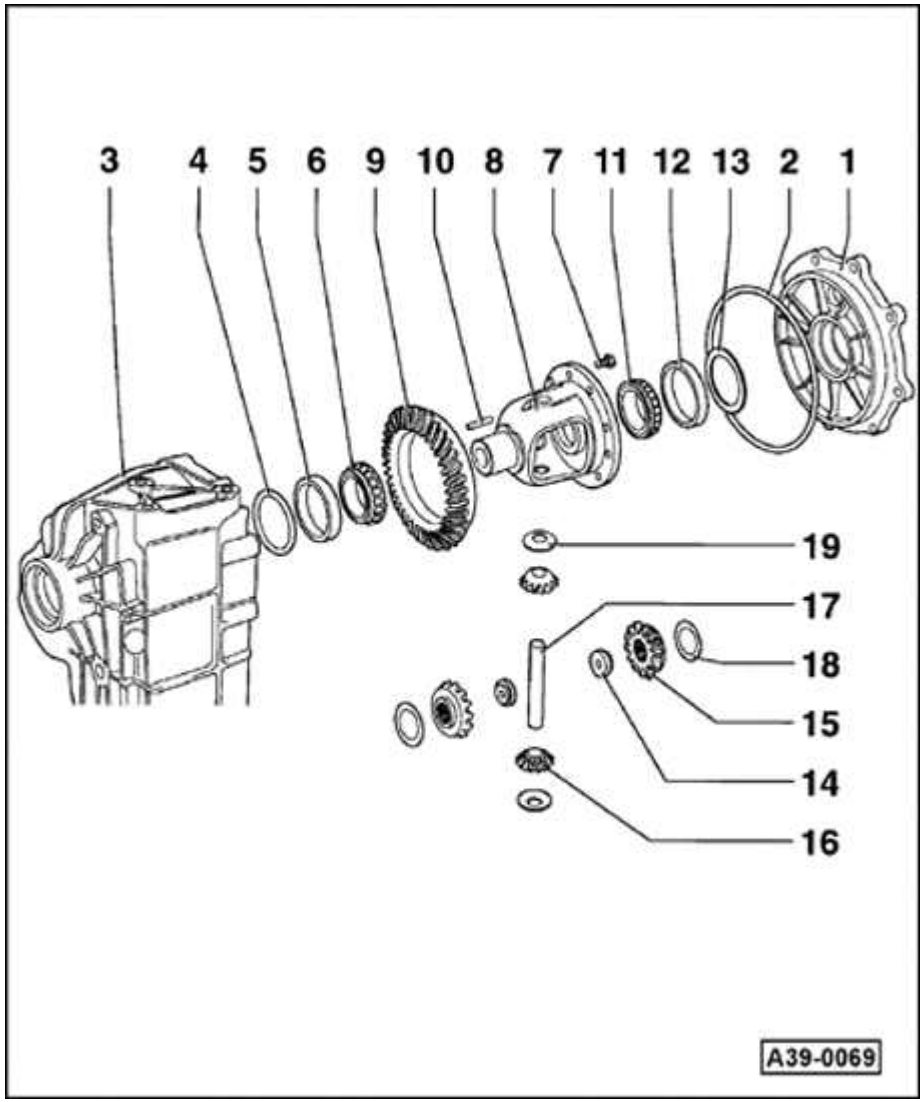
16 - Differential bevel gears, small

- Installing ⇒ Fig. 11

17 - Differential bevel gear shaft

- Drive out using drift
- Carefully drive in, so that thrust washer is not damaged
- Secure with roll pin (item -10-)

39-125



18 - Shim

- Re-determining thickness ⇒ Fig. 12

19 - Thrust washer

- Check for cracks

39-126

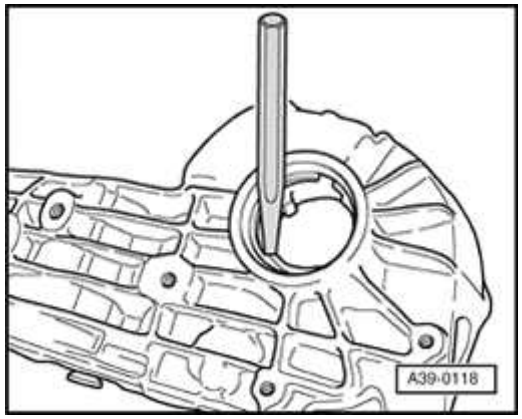


Fig. 1 Removing small tapered roller bearing outer race from final drive housing

- After removing, check shims for damage.

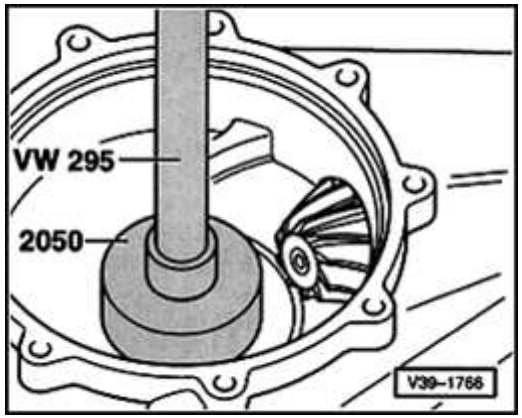


Fig. 2 Pressing small tapered roller bearing outer race into rear final drive housing (drive in to stop)

- Using VW295 needle bearing drift, lightly tap outer race into place.
- Drive in until stop is reached as shown in illustration.

39-127

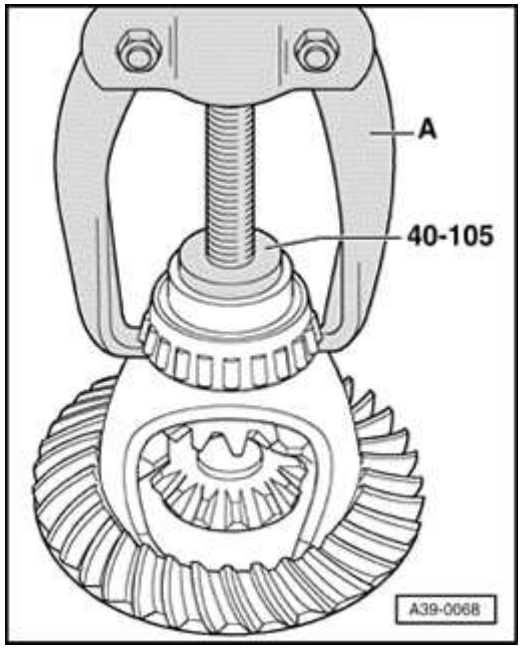


Fig. 3 Removing small tapered roller bearing inner race

A - Two arm puller, e.g. Kukko 44/2

39-128

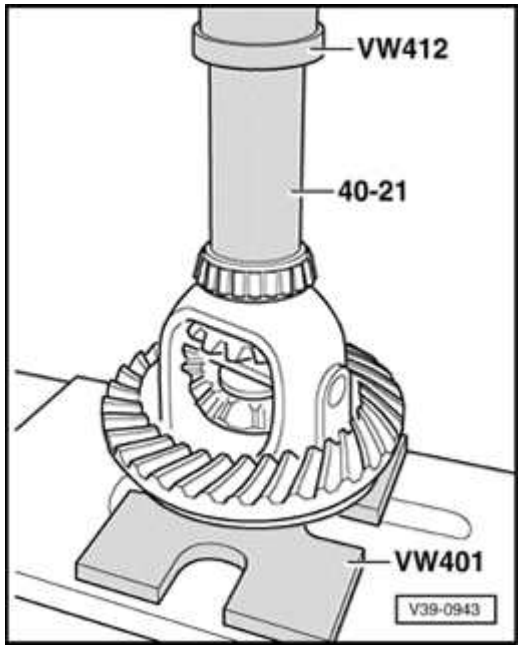


Fig. 4 Installing small tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

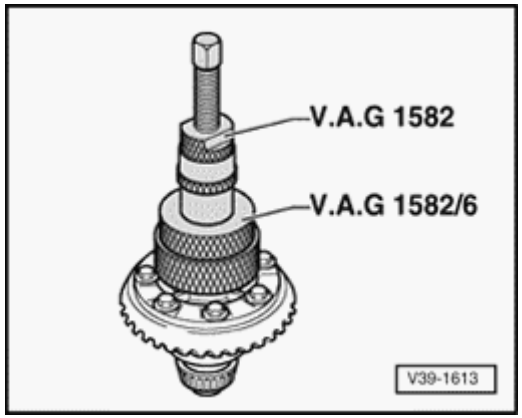


Fig. 5 Removing large tapered roller bearing inner race

- Before installing extractor, position 40-105 thrust piece on differential housing.

39-129

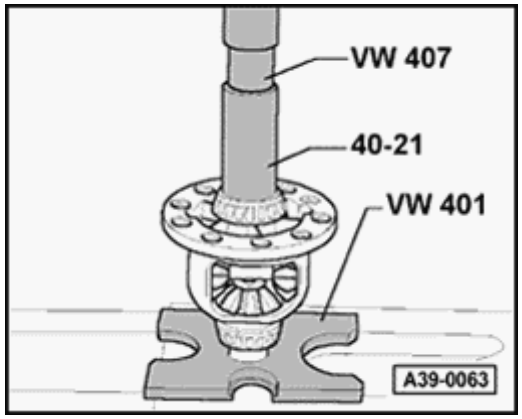


Fig. 6 Installing large tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

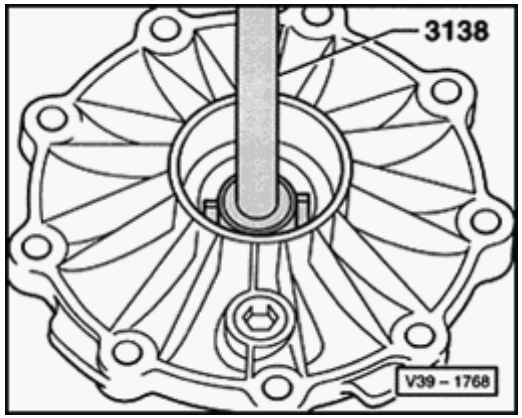


Fig. 7 Removing large tapered roller bearing outer race from final drive cover

- After removing, check shims for damage.

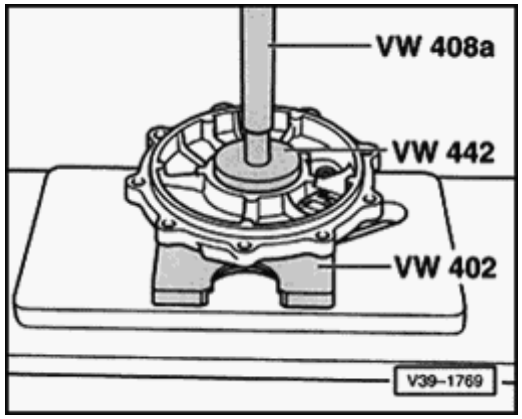


Fig. 8 Installing large tapered roller bearing outer race into final drive cover

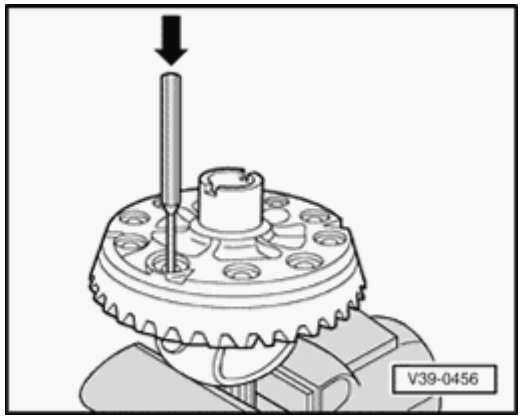


Fig. 9 Removing ring gear from differential housing

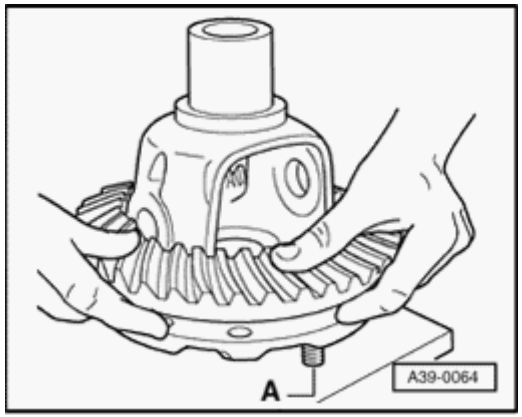


Fig. 10 Installing ring gear

- Use 2 centering pins -A- (locally available) as guides.

WARNING!

Wear protective gloves.

- Heat ring gear to approx. 100 ° C (212 ° F) and install.

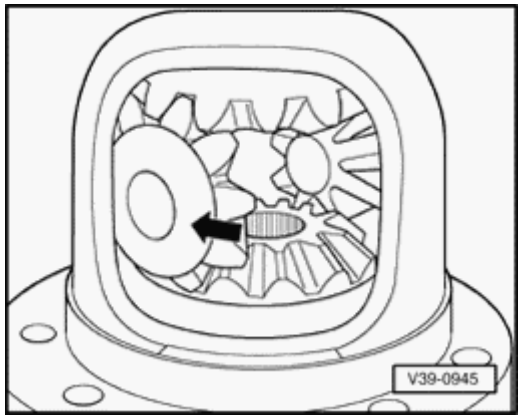


Fig. 11 Installing differential bevel gears

- If large differential bevel gears have been replaced, measure and select new shims ⇒ Fig. 12 .
- Insert large differential bevel gears with measured shims.
- Install small differential bevel gears (turned 180 °) from their final position, and rotate into place (arrow).
- Install and align thrust washers.
- Insert threaded pieces.
- Drive differential gear shaft for bevel gears in to stop and secure with roll pin.

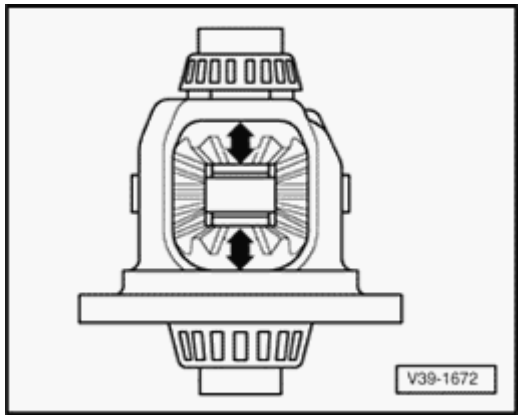


Fig. 12 Adjusting differential bevel gears

- Insert large differential bevel gears with thinnest shims (0.5 mm).
- Insert small differential bevel gears (turned 180°) together with thrust washers.

Note:

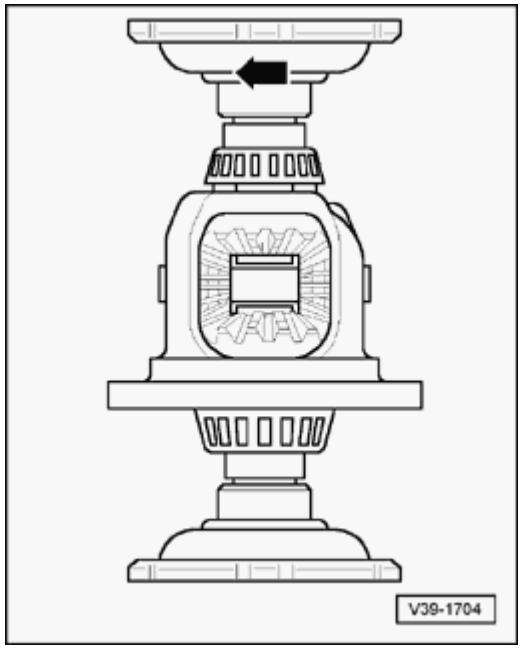
From this point on, do not interchange differential bevel gears and their respective thrust washers.

- Drive in differential bevelgear shaft.
- Press small differential bevel gears outward.
- Press large differential bevel gears in direction indicated (arrows), and check play.
- Determine thickest shims for large differential bevel gears (on each side) which still just fits.
- Shims for both sides should be of equal thickness.
- Identify shims according to table. Part numbers ⇒ parts catalog

The following shims are available:

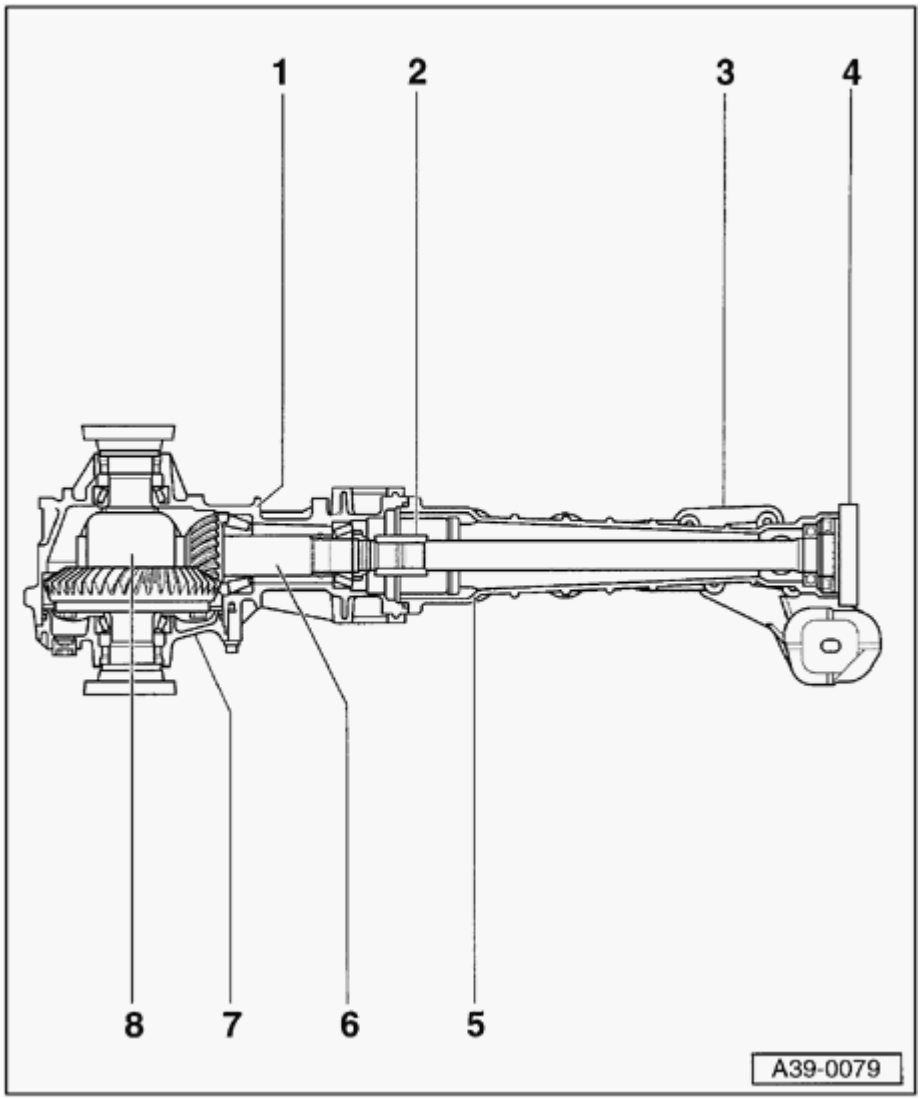
Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

Note:



The adjustment is also correct if no further play is perceptible, as long as the differential bevel gears can still be turned (arrow).

39-124



Rear final drive, disassembling and assembling

Overview

Notes:

- *Disconnect torque tube from rear final drive with the final drive installed* ⇒ *page 39-95* .
- *Disconnect torque tube from rear final drive with the final drive removed* ⇒ *page 39-126* .

1 - Final drive housing

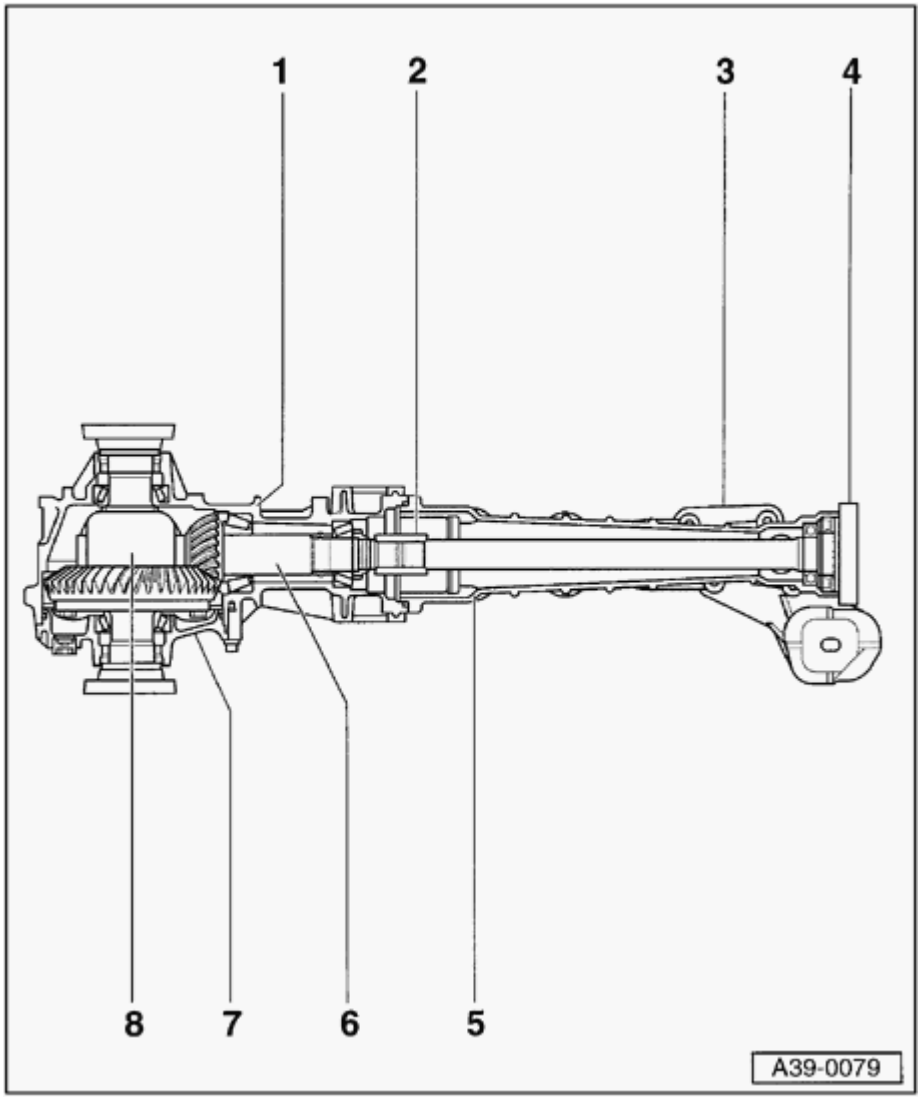
2 - Sleeve

3 - Transmission support

4 - Driveshaft flange

- Removing ⇒ page 39-108

39-125



5 - Torque tube

- Removing and installing ⇒ page 39-95

6 - Drive pinion

- Matched to ring gear
- Removing and installing differential gear ⇒ page 39-152

7 - Cover for final drive

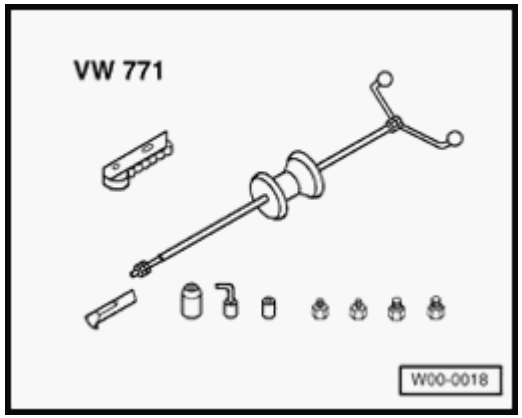
8 - Differential

- Remove before removing drive pinion
- Removing and installing ⇒ page 39-128
- Disassembling and assembling ⇒ page 39-136

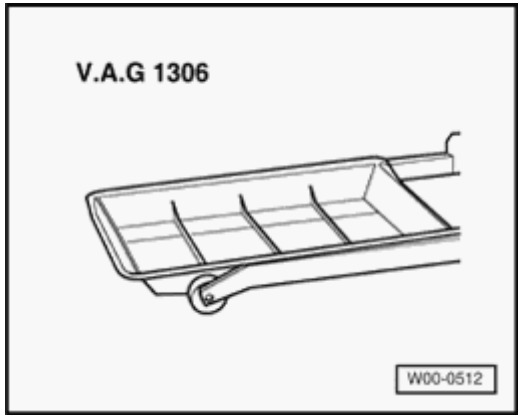
39-126

Disconnect torque tube from rear final drive.

Special tools and equipment



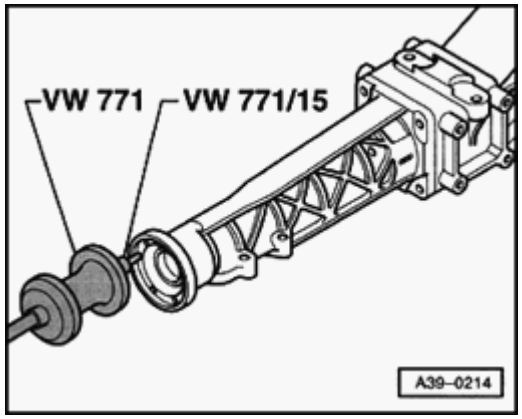
- ♦ VW 771 slide hammer-complete set with 771/15 threaded piece



- ♦ VAG1306 drip tray

• Rear final drive removed

- Secure rear final drive to assembly stand ⇒ page 39-123 .
- Place VAG1306 drip tray underneath and drain gear oil.
- Remove bolts for torque tube/housing for final drive.



- Pull torque tube off of drive flange, and intercept it.

39-134

Drive pinion, removing, installing, disassembling and assembling

Special tools, testers and auxiliary items

- Press plate VW 401
- Press plate VW 402
- Press tool VW 407
- Press tool VW 408 A
- Press tool VW 412
- Support rails VW 457
- Mandrel VW 460/2
- Tube VW 519
- Engine and transmission support VW 540
- Thrust plate 30-205

- Installing ring 2003/3
- Pinion assembly appliance 2052/2
- Thrust plate 3005

39-135

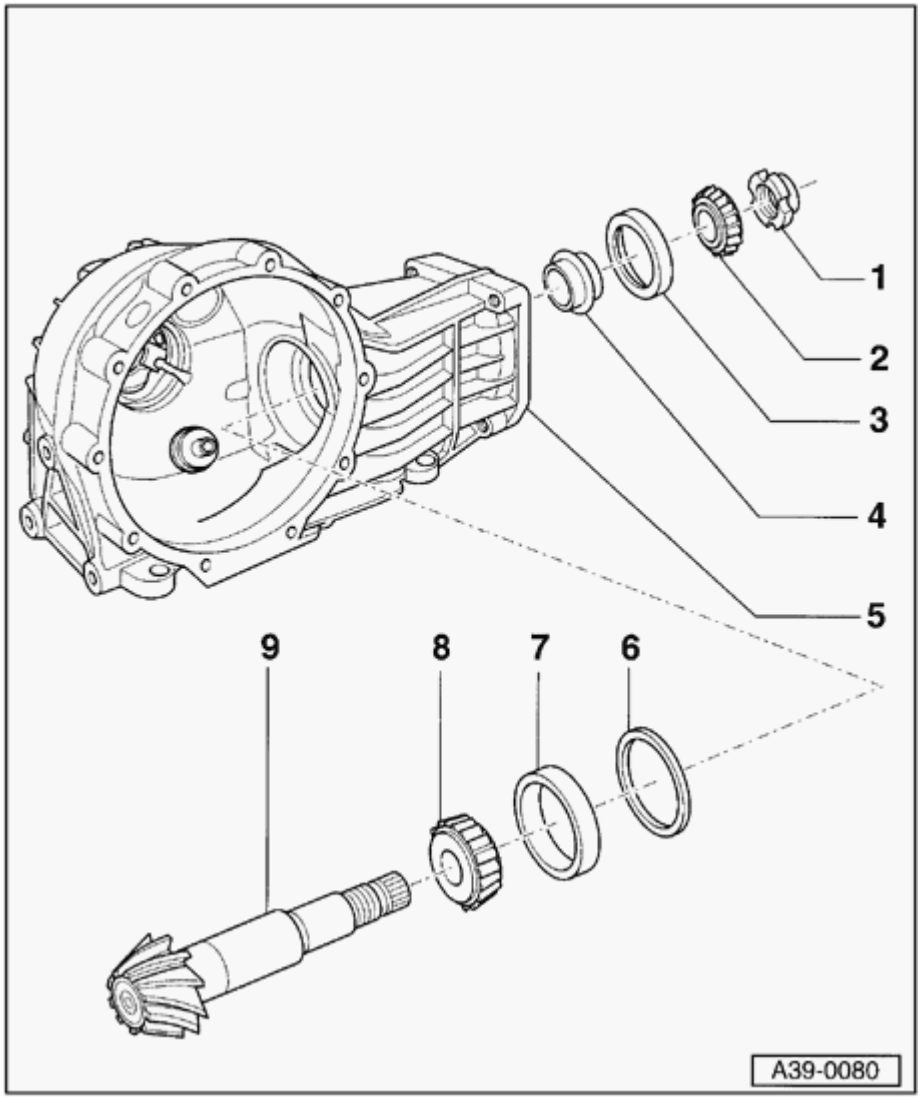
- Thrust pad 3062
- Drift 3138
- Fitting appliance 3253 with 3253/3 and 3253/4
- Retainer 3304
- Engine/transmission jack V.A.G 1383 A
- Universal support V.A.G 1359/2
- Separating tool Kukko 17/2
- Two-arm puller Kukko 21/7
- Counter-support Kukko 22/2
- Torque gauge 0-600 Ncm
- Socket attachment (long), 32 mm A/F

39-136

Note:

- *General repair instructions ⇒ Page 00-11 .*
- *Removing drive flange housing from rear final drive with final drive installed ⇒ Page 39-82 .*
- *Removing drive flange housing from rear final drive with final drive removed ⇒ Page 39-111 .*
- *Replace both tapered roller bearings together. Use same make if possible.*
- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *Removing differential ⇒ Page 39-112 .*
- *Adjustments are required when replacing components marked with a 1) ⇒ Page 39-150 , Adjustment overview*

39-137



1 - Nut

- Always replace
- Removing ⇒ Fig. 1 and ⇒ Fig. 2
- Installing ⇒ Fig. 11
- Measuring friction torque ⇒ Fig. 12
- Securing ⇒ Fig. 13

2 - Inner race for small tapered roller bearing 1)

- Pressing out drive pinion ⇒ Fig. 3
- Installing ⇒ Fig. 10

3 - Outer race for small tapered roller bearing 1)

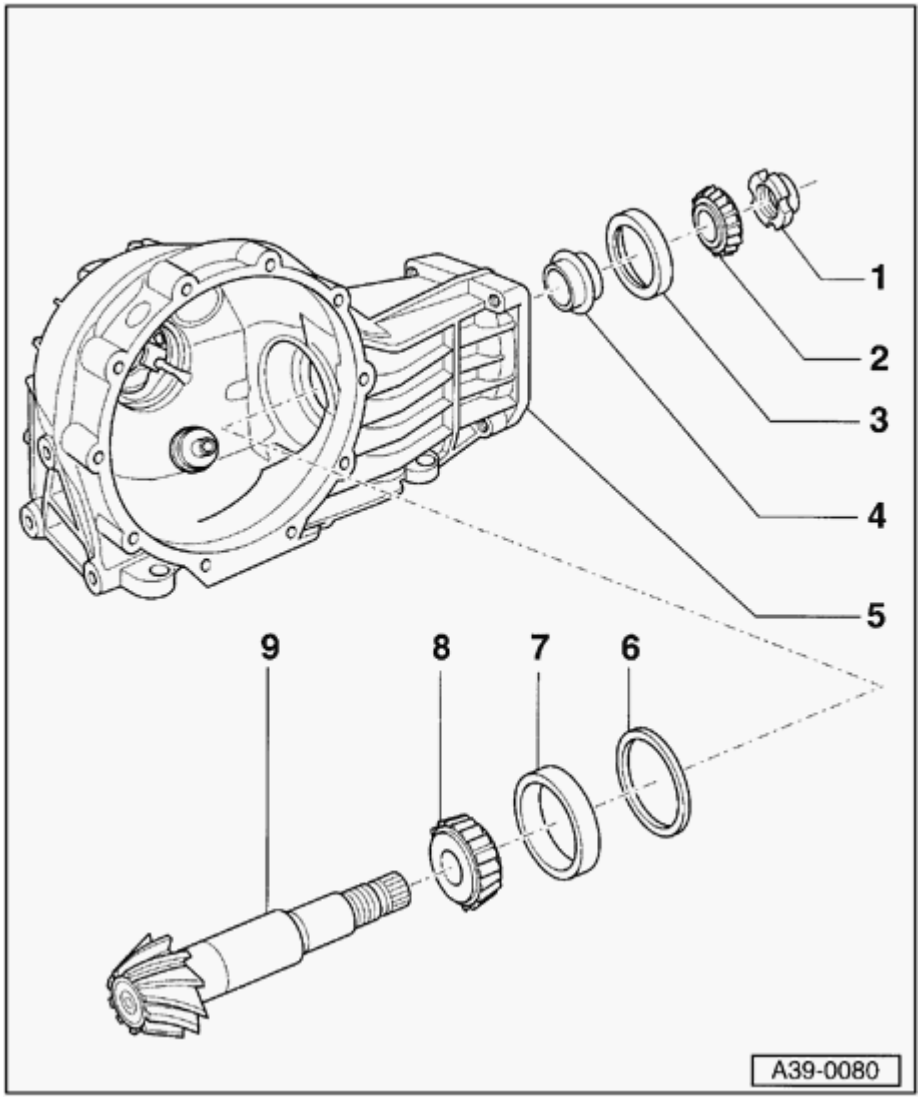
- Pulling out ⇒ Fig. 4
- Pressing in ⇒ Fig. 9

4 - Spacer sleeve 1)

- Always replace

5 - Final drive housing 1)

39-138



6 - Shim "S3"

- Note thickness
- Adjustment overview ⇒ Page 39-150

7 - Outer race for large tapered roller bearing 1)

- Driving out ⇒ Fig. 5
- Pulling in ⇒ Fig. 8

8 - Inner race for large tapered roller bearing 1)

- Pulling off ⇒ Fig. 6
- Pressing on ⇒ Fig. 7

9 - Drive pinion 1)

- Is mated with ring gear, always replace together as a set

39-139

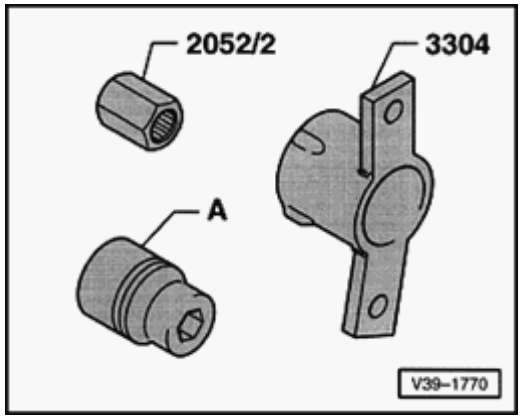


Fig. 1 Tools for loosening and tightening drive pinion nut

A - Socket (32 mm)

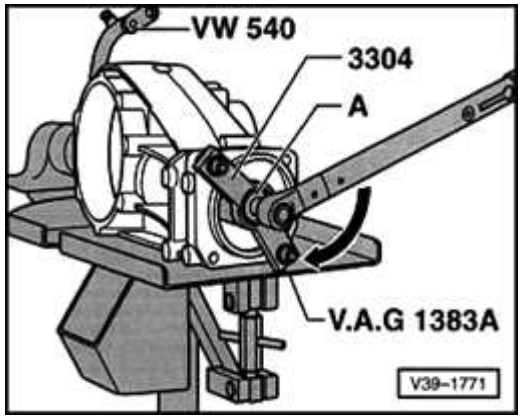


Fig. 2 Removing nut for drive pinion

- Secure retainer 3304 with two M8 x 30 hex bolts.
- Support final drive when loosening nut (e.g. using universal support V.A.G 1359/2 in combination with transmission jack V.A.G 1383 A).

39-140

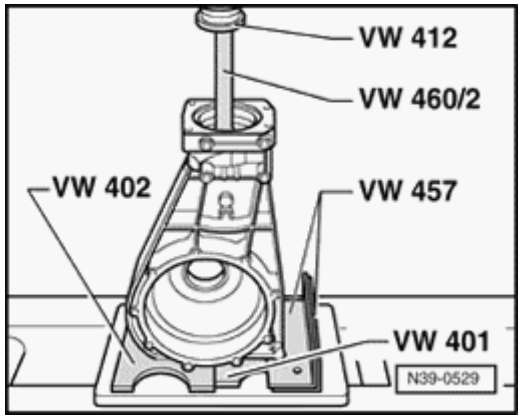


Fig. 3 Pressing drive pinion out of inner race for small tapered roller bearing

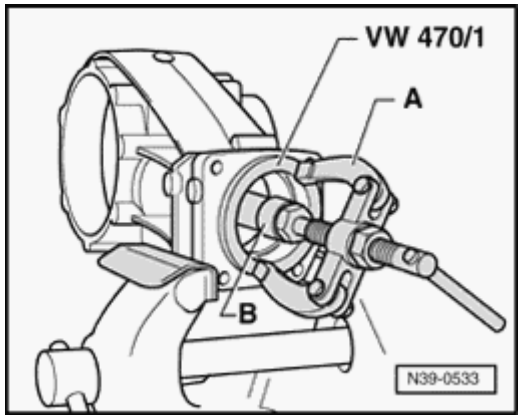


Fig. 4 Pulling out outer race for small tapered roller bearing

A - Counter support e.g. Kukko 22/2

B - Internal puller 46-58 mm, e.g. Kukko 21/7

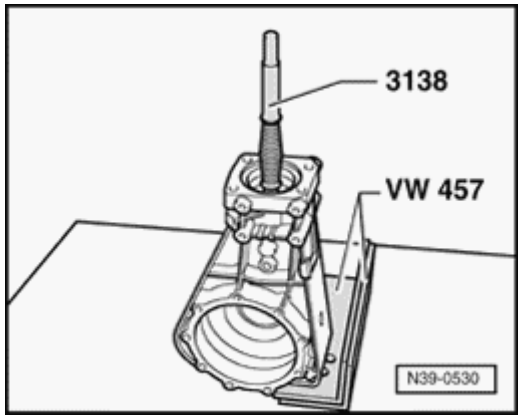


Fig. 5 Driving out outer race for large tapered roller bearing

- After removing check shims for damage.

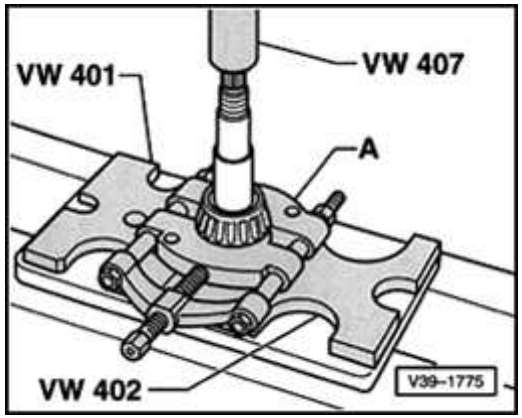


Fig. 6 Pressing inner race for large tapered roller bearing off drive pinion

A - Separating device 22-115 mm, e.g. Kukko 17/2

39-142

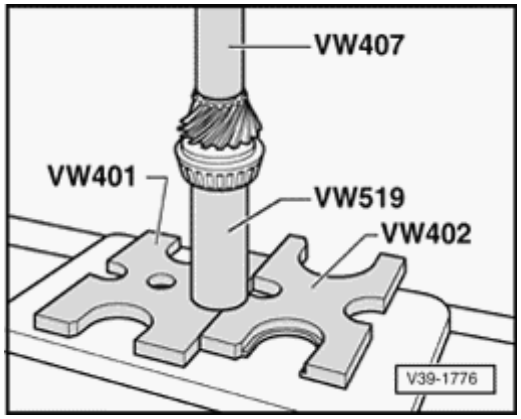


Fig. 7 Pressing inner race for large tapered roller bearing onto drive pinion

CAUTION!

Wear protective gloves.

- Heat bearing to approx. 100 ° C, fit in position and press home.

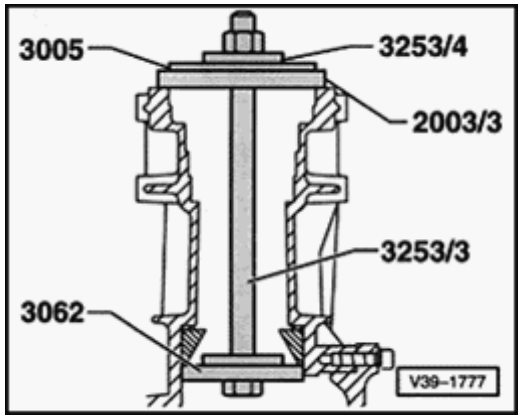


Fig. 8 Pulling in outer race for large tapered roller bearing

- Insert predetermined shim "S3" for drive pinion ⇒ Page 39-154 .

Note:

Inscription "Oben" faces the nut of the puller with thrust washer 3253/4.

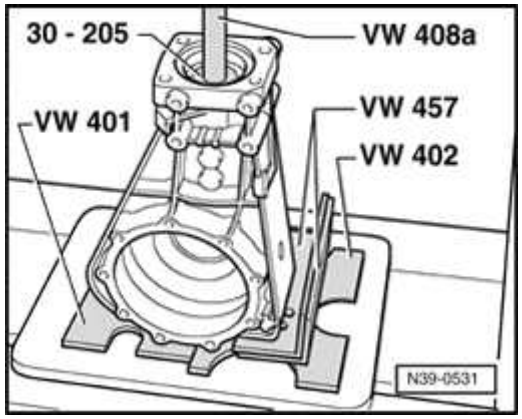


Fig. 9 Pressing in outer race for small tapered roller bearing

- Lubricate outer race with oil and fit using press tool VW 408 A and thrust plate 30-205.

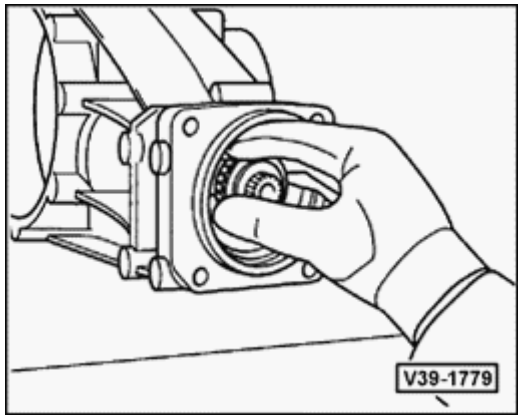


Fig. 10 Pressing on small tapered roller bearing inner race

CAUTION!

Wear protective gloves.

- Insert drive pinion with new spacer sleeve.
- Heat inner race for small tapered roller bearing to approx. 100 ° C and fit onto drive pinion.
- Press up drive pinion and insert bearing with thrust plate 40-21 onto stop.

39-144

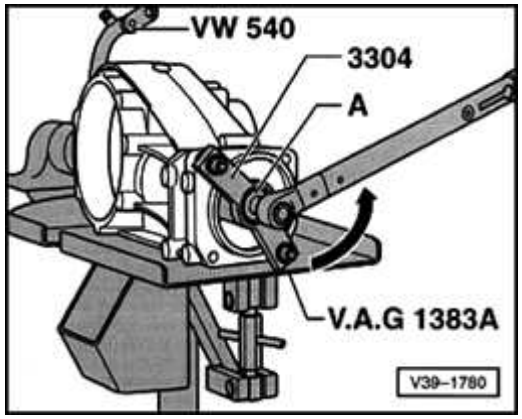


Fig. 11 Tightening nut for drive pinion and measuring friction torque

- Secure retainer 3304 with two M8 x 30 hexagon bolts.
- Support final drive when tightening nut (e.g. using universal support V.A.G 1359/2 in conjunction with transmission jack V.A.G 1383 A).
- Fit a new drive pinion nut.
- Tighten drive pinion nut just far enough so that no play can be felt at drive pinion.
- Gradually increase tightening torque, checking friction torque at regular intervals, until specified friction torque is obtained ⇒ Fig. 12 .

Note:

If the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve which has been compressed too much cannot be reused.

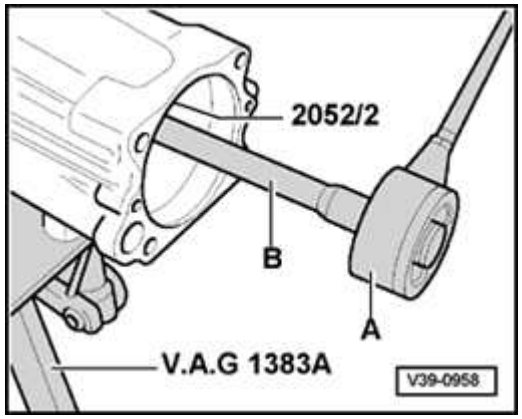


Fig. 12 Measuring friction torque

A - Torque gauge, commercially available, 0-600 Ncm

B - Extension with 32 mm socket

- The following friction torques should be set:

New bearings	Used bearings 1)
200-250 Ncm	30-60 Ncm

1) run at least 50 km (30 miles)

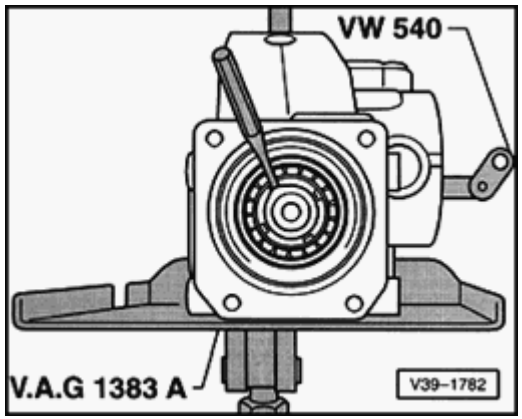


Fig. 13 Securing drive pinion nut

- Peen drive pinion nut with punch.

Pinion shaft, removing, installing and servicing

Special tools and equipment

- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 thrust disc
- VW457 support channels
- VW460/2 mandrel
- VW519 sleeve
- VW540 engine/transmission support
- 30-205 thrust pad

- 2003/3 seal installer
- 2052/2 assembly tool for pinion shaft
- 3005 thrust pad

39-135

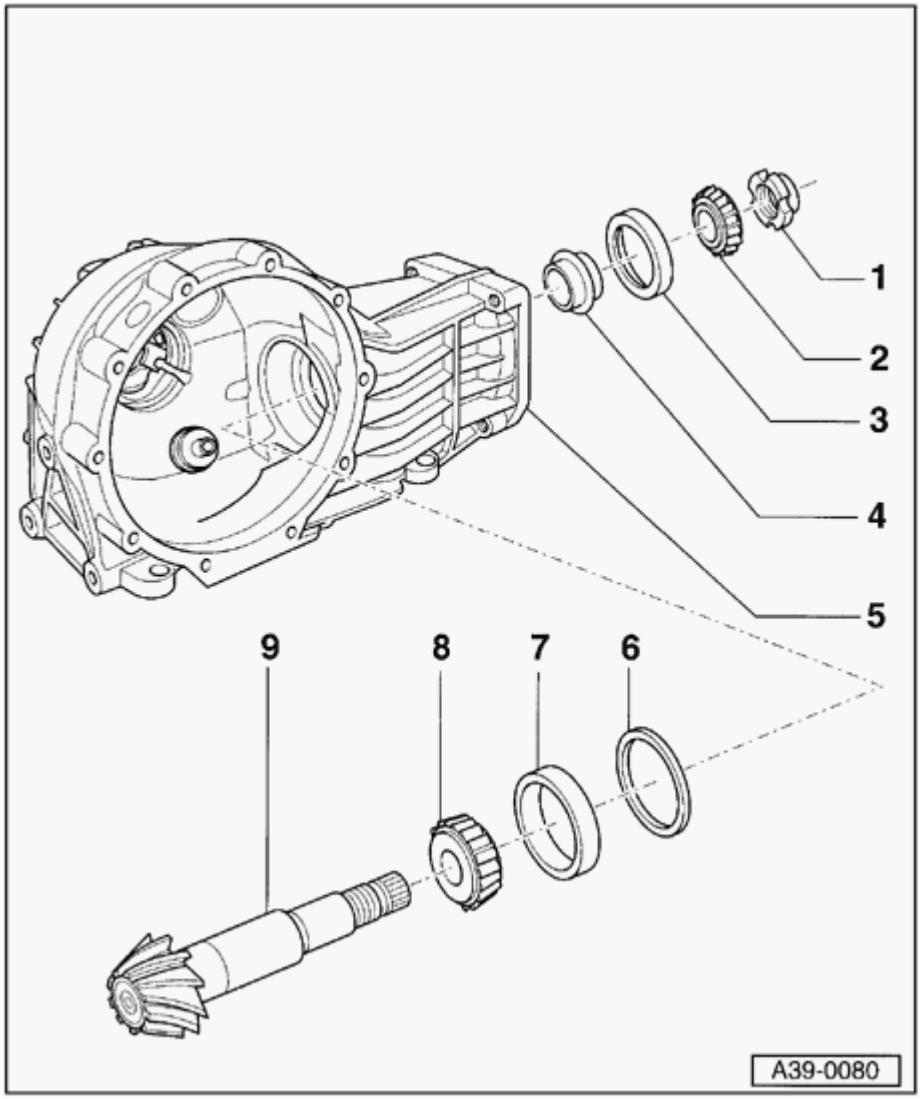
- 3062 thrust pad
- 3138 drift
- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 bracket
- VAG1383A engine/transmission support
- VAG1359/2 universal mount
- Kukko 17/2 separating tool
- Kukko 21/7 extractor
- Kukko 22/2 support
- Torque gauge 0-600 Ncm (0-53 in. lb)
- 32 mm socket

39-136

Notes:

- *Observe general repair instructions ⇒ Page 00-14 .*
- *With the final drive installed, remove the drive flange housing from the rear final drive ⇒ Page 39-86 .*
- *With the final drive removed, remove the drive flange housing from the rear final drive ⇒ Page 39-119 .*
- *Always replace both tapered roller bearings together as a set. If possible, use same manufacturer.*
- *Do not oil new tapered roller bearings for the friction torque measurement. The bearings are already factory treated with a special oil.*
- *Remove differential ⇒ Page 39-114 .*
- *Adjustments are required when replacing components marked with "1)" ⇒ List of adjustments, ⇒ Page 39-149 .*

39-137



1 - Pinion shaft nut

- Always replace
- Removing ⇒ Figs. 1 and ⇒ 2
- Installing ⇒ Fig. 1
- Measuring friction torque ⇒ Fig. 12
- Securing ⇒ Fig. 13

2 - Small tapered roller bearing inner race1)

- Removing pinion shaft ⇒ Fig. 3
- Installing ⇒ Fig. 10

3 - Small tapered roller bearing outer race1)

- Removing ⇒ Fig. 4
- Installing ⇒ Fig. 9

4 - Spacer sleeve1)

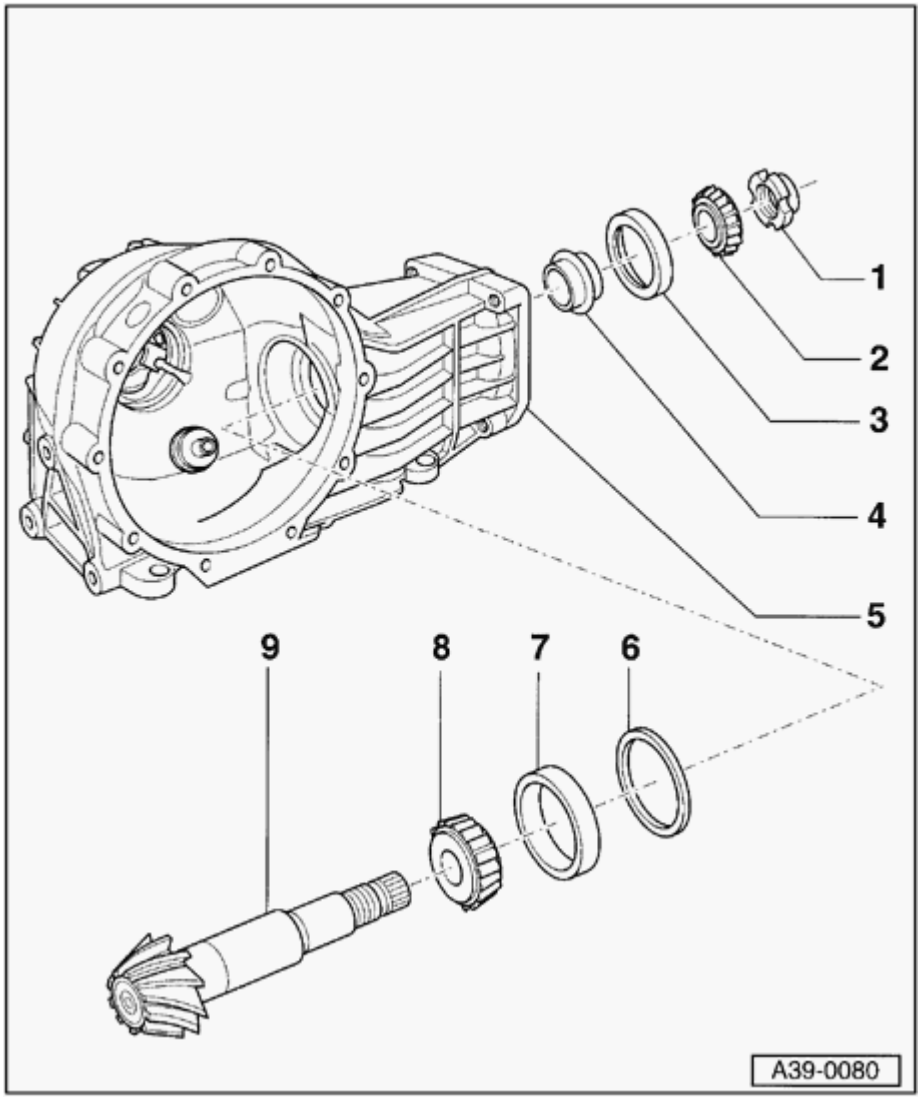
- Always replace

5 - Final drive housing1)

6 - Shim S3

- Note thickness
- List of adjustments ⇒ Page 39-149

39-138



7 - Large tapered roller bearing outer race1)

- Removing ⇒ Fig. 5
- Installing ⇒ Fig. 8

8 - Large tapered roller bearing inner race1)

- Removing ⇒ Fig. 6
- Installing ⇒ Fig. 7

9 - Pinion shaft1)

- Is matched with ring gear, always replace as a set

39-139

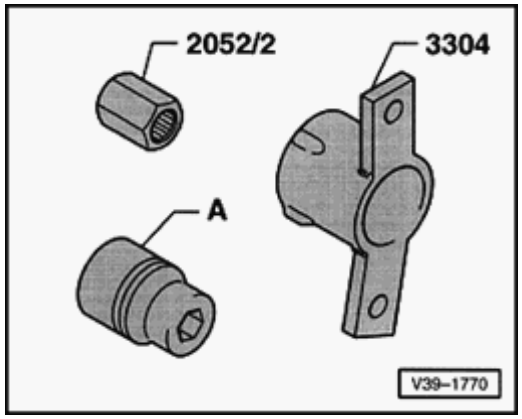


Fig. 1 Tool to loosen and tighten pinion shaft nut

A- 32 mm socket

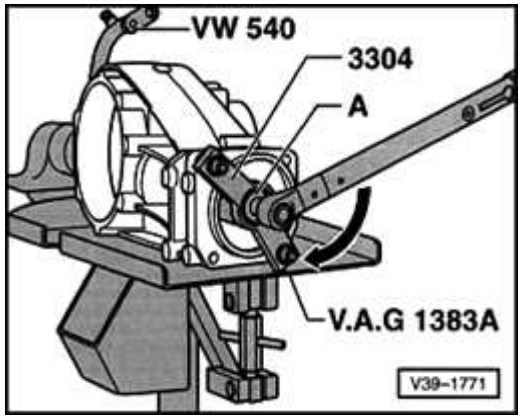


Fig. 2 Removing pinion shaft nut

- Screw 3304 bracket on using two M8 x 30 hex-head bolts.
- Final drive must be supported when loosening nut (e.g. using VAG1359/2 universal transmission attachment in combination with VAG1383A transmission jack).

39-140

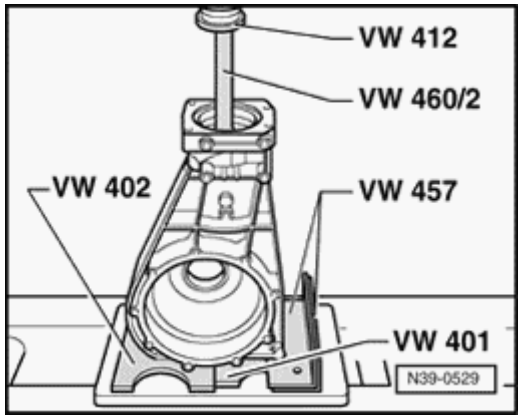


Fig. 3 Removing pinion shaft from small tapered roller bearing inner race

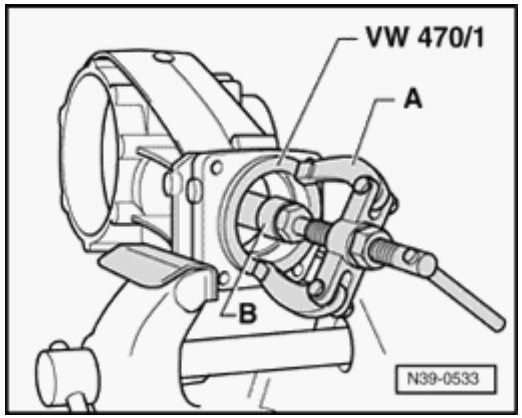


Fig. 4 Removing small tapered roller bearing outer race

A - Counter support e.g. Kukko 22/2

B - Internal puller 46-58 mm, e.g. Kukko 21/7

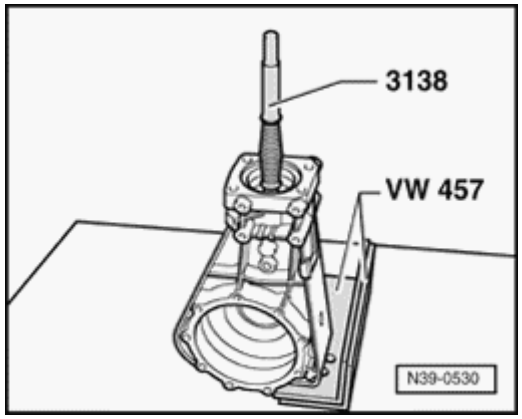


Fig. 5 Removing large tapered roller bearing outer race

- After removing, check shims for damage.

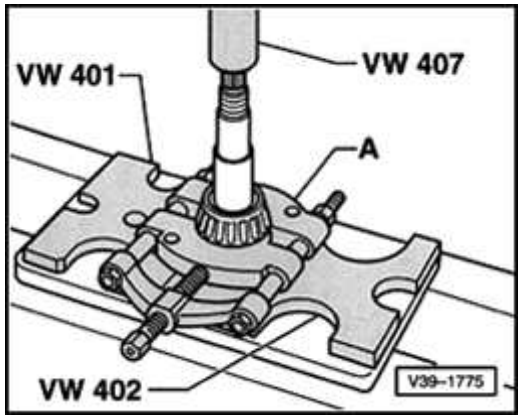


Fig. 6 Removing large tapered roller bearing inner race from pinion shaft

A - Separating device 22-115 mm, e.g. Kukko 17/2

39-142

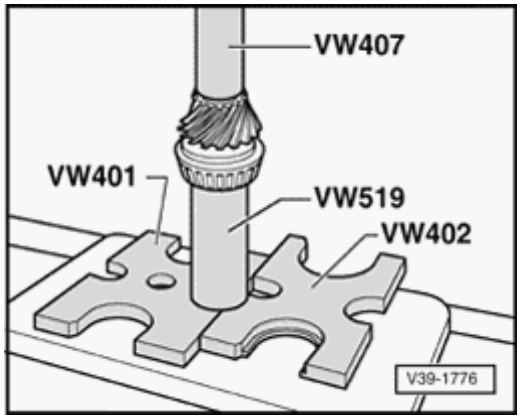


Fig. 7 Installing large tapered roller bearing inner race onto pinion shaft

WARNING!

Wear protective gloves.

- Heat bearing to approx. 100 ° C (212 ° F), install and press down.

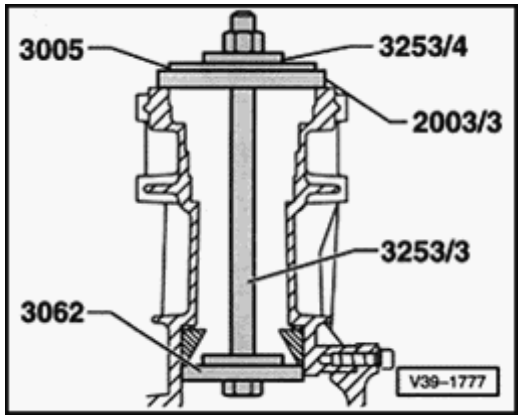


Fig. 8 Installing large tapered roller bearing inner race onto pinion shaft

- First insert predetermined shim S3 for pinion shaft ⇒ Page 39-149 .

Note:

The marking "Oben" on 3253/4 thrust piece faces the nut of the puller.

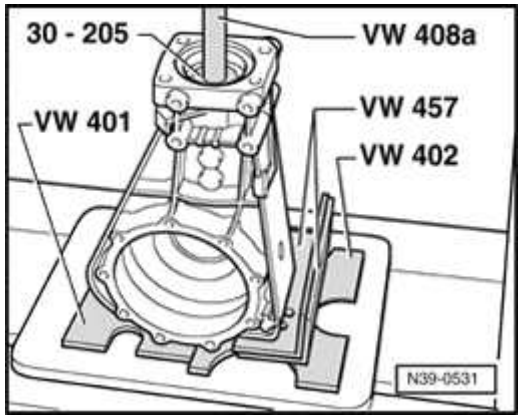


Fig. 9 Installing small tapered roller bearing outer race

- Oil outer race, and position using VW408A punch and 30-205 thrust pad.

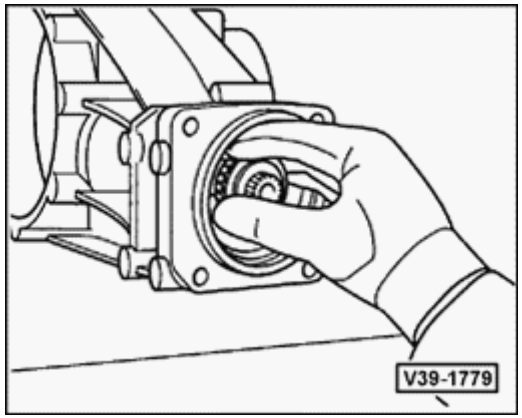


Fig. 10 Installing small tapered roller bearing inner race

WARNING!

Wear protective gloves.

- Insert pinion shaft with new spacer sleeve.
- Heat small tapered roller bearing inner race to approx. 100 ° C (212 ° F) and install onto pinion shaft.
- Lift up pinion shaft and press bearing using 40-21 sleeve up to stop.

39-144

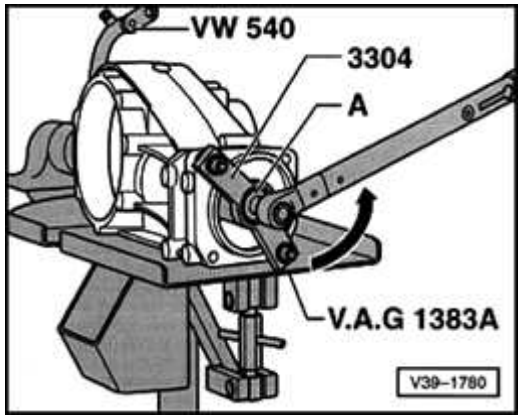


Fig. 11 Tightening nut for pinion shaft and measuring friction torque

- Attach 3304 using two M8 x 30 hex-head bolts.
- Final drive must be supported when tightening nut (e.g. using VAG1359/2 universal transmission attachment in combination with VAG1383A transmission jack).
- Replace nut for pinion shaft.
- Tighten nut for pinion shaft, until no more play can be felt on pinion shaft.
- Increase tightening torque until specified friction torque is attained, measuring friction torque several times during this process ⇒ Fig. 12 .

Note:

If the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.

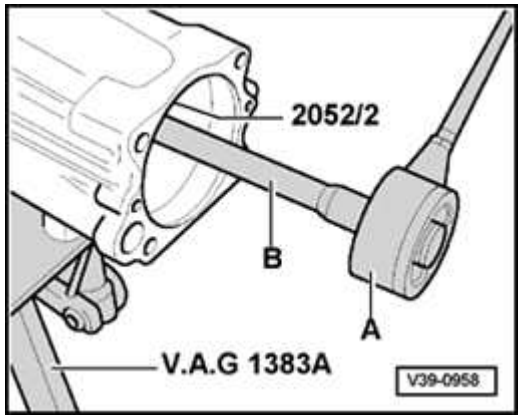


Fig. 12 Measuring friction torque

A - Torque gauge, 0-600 Ncm (53 in. lb) (commercially available)

B - Socket attachment, 32 mm

- Following friction torque should be set:

New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

1) Must have run at least 50 km (30 miles)

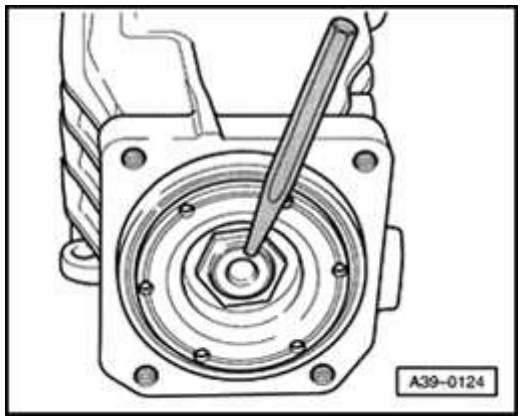
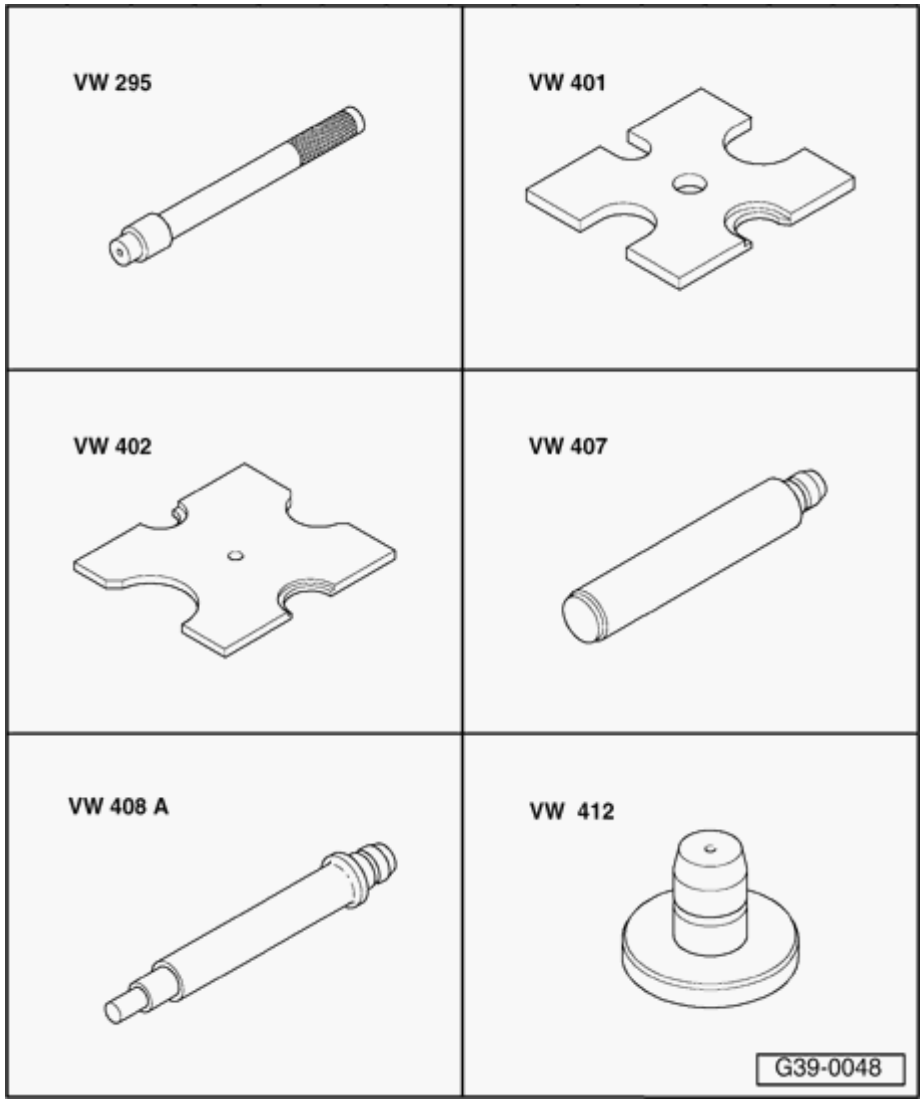


Fig. 13 Securing pinion shaft nut

- Secure pinion shaft nut using mandrel.

39-136

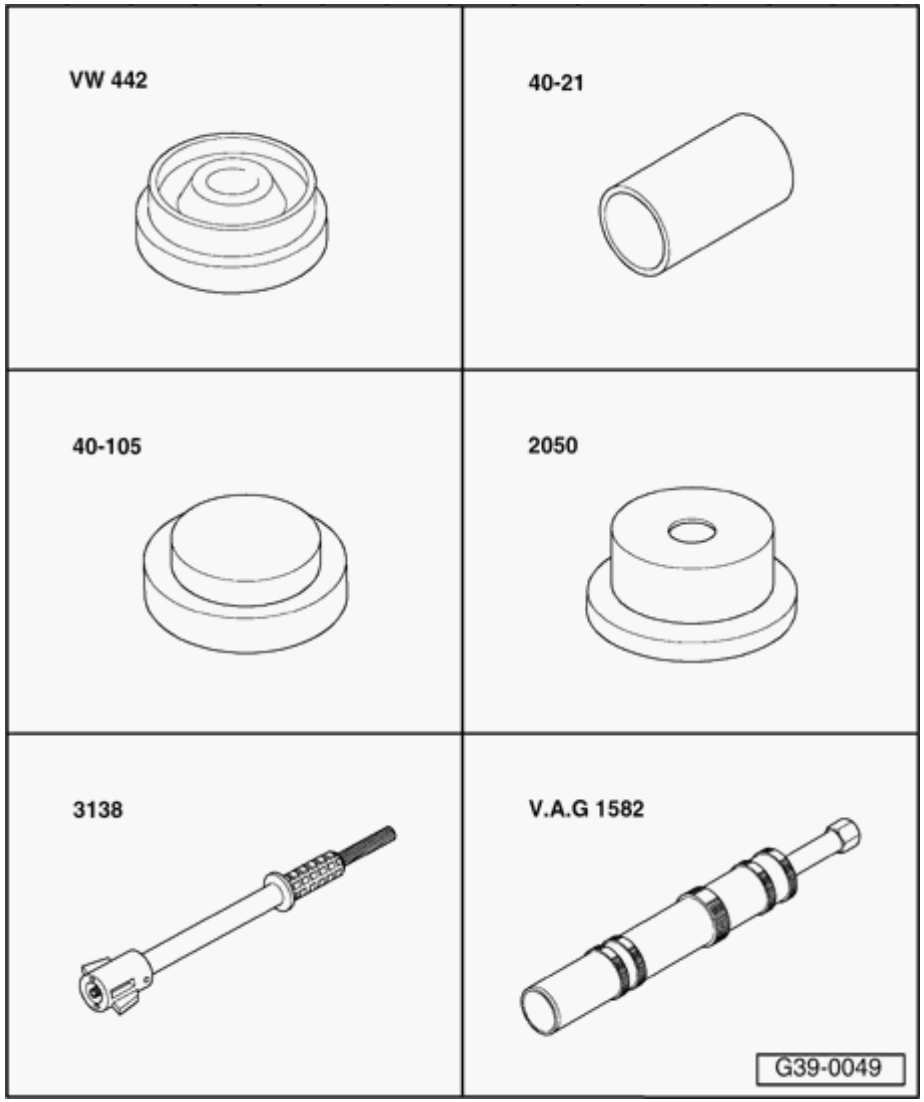


Differential, disassembling and assembling

Special tools and equipment

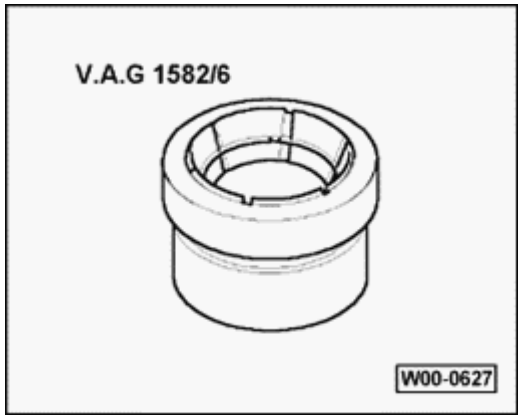
- VW295 needle bearing drift
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 punch

39-137

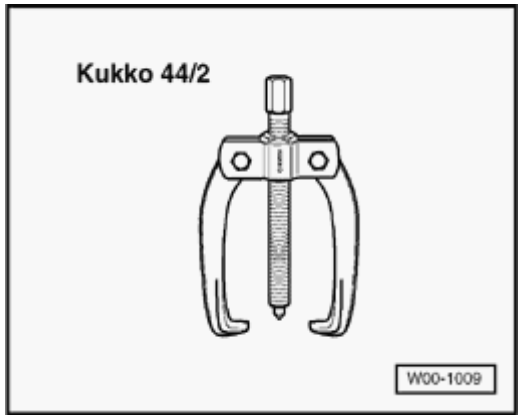


- VW442 thrust pad
- 40-21 sleeve
- 40-105 thrust pad
- 2050 thrust plate
- 3138 drift
- Tapered roller bearing puller VAG1582 taper roller bearing puller

39-138

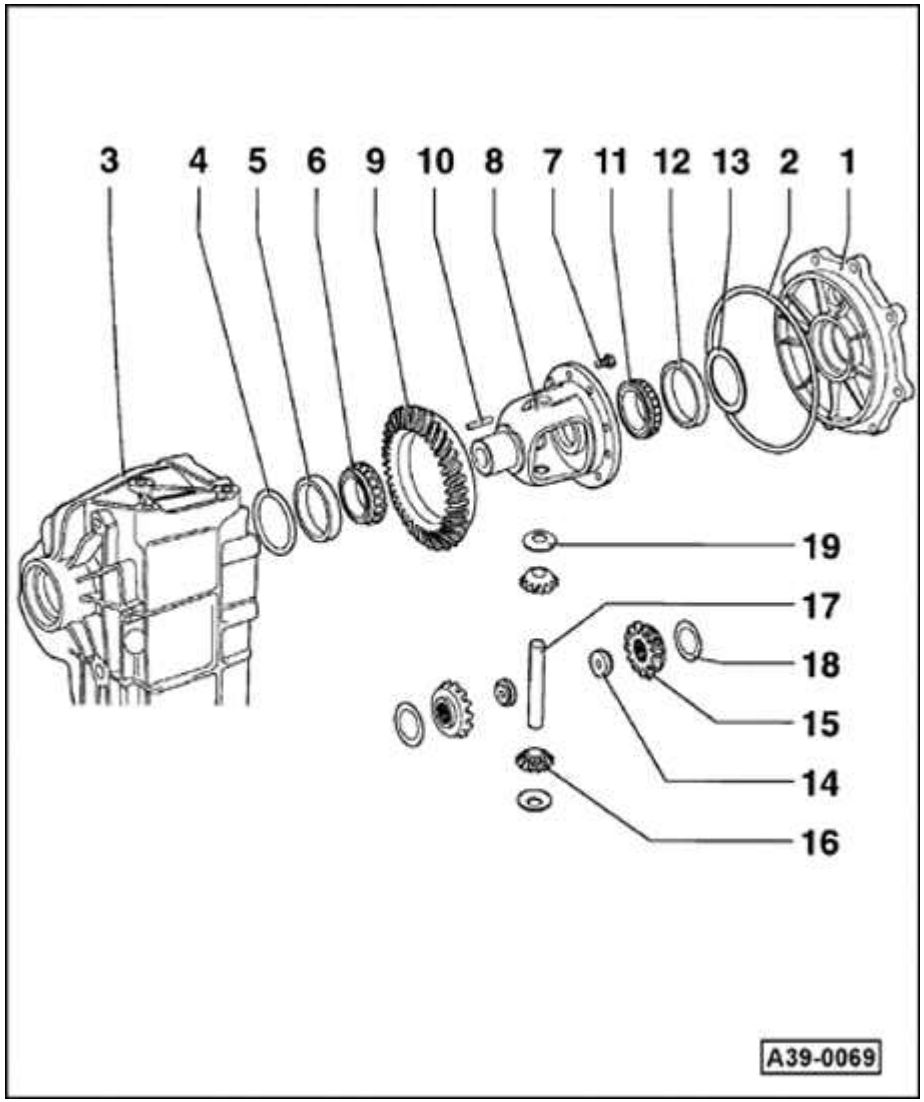


- VAG1582/6 attachment to VAG1582



- Kukko 44/2 two-arm puller

39-139



Notes:

- *General repair notes: ⇒ page 00-27 .*
- *Replace both tapered roller bearings together. If possible, use same manufacturer!*
- *Adjustments are required when replacing components marked with 1) ⇒ Adjustment overview ⇒ page 39-170 .*

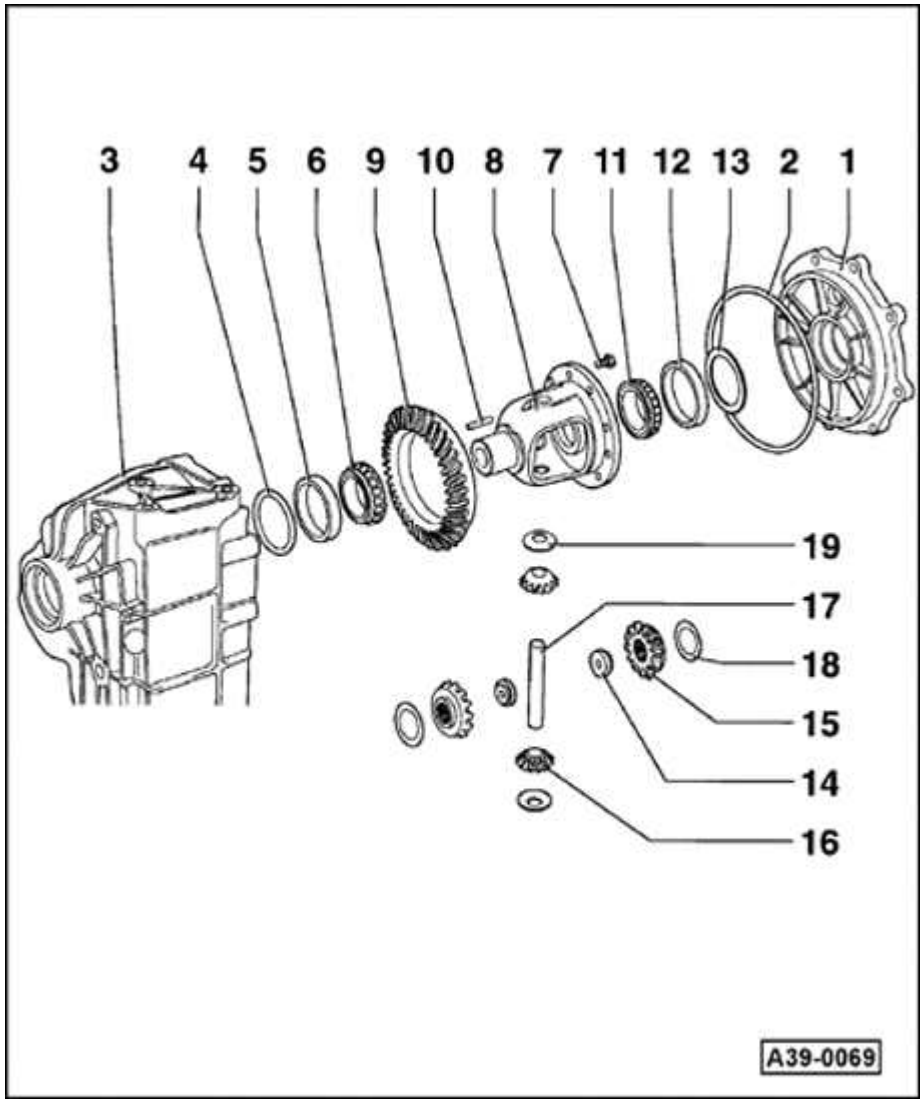
1 - Cover for final drive 1)

2 - O-ring

- Always replace
- Insert with oil

3 - Final drive housing 1)

39-140



4 - Shim "S2"

- Note thickness
- Adjustment overview ⇒ page 39-170

5 - Small tapered roller bearing outer race 1)

- Driving out ⇒ Fig. 1
- Pressing in ⇒ Fig. 2

6 - Small tapered roller bearing inner race 1)

- Pulling off ⇒ Fig. 3
- Pressing on ⇒ Fig. 4

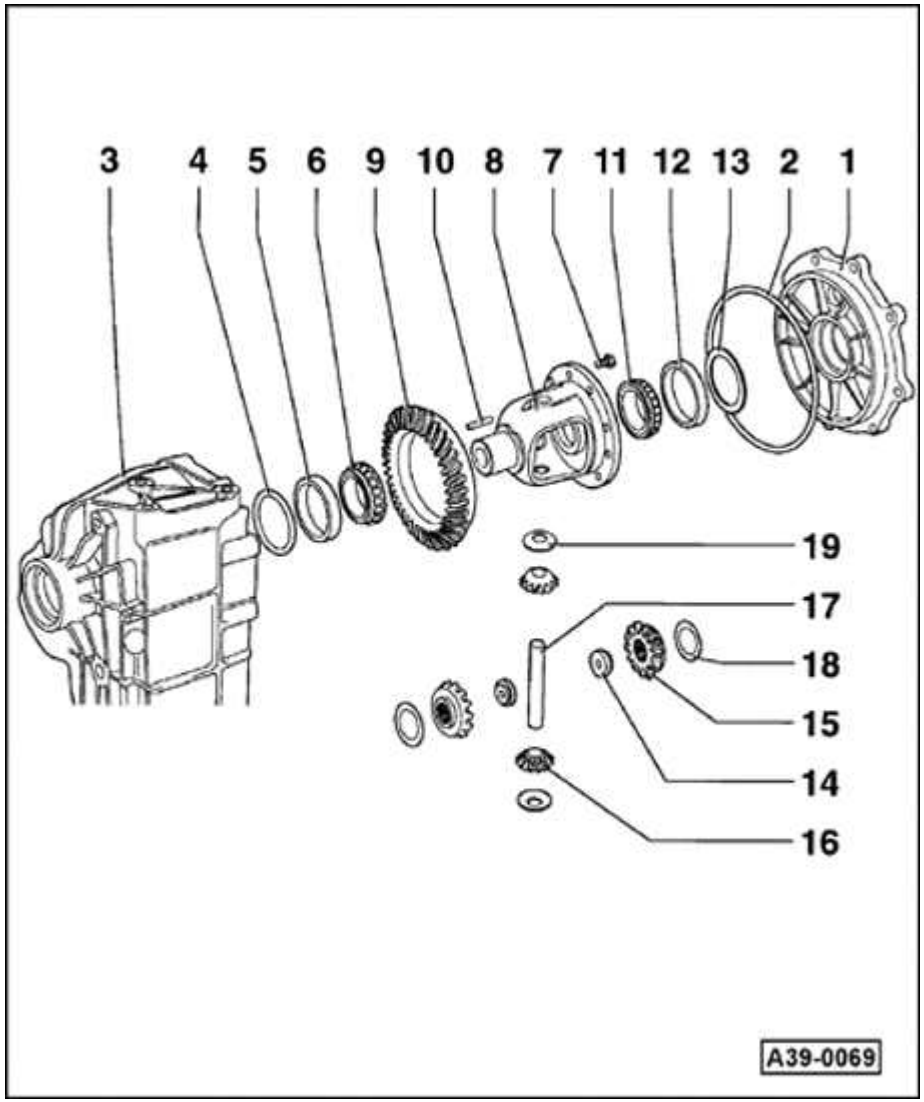
7 - Bolt - tighten to 60 Nm and then tighten an additional 45-5.

- Always replace
- Allocation

⇒ *Parts-catalog*

- Lightly tighten bolts then tighten diagonally to correct torque.

39-141



8 - Differential housing [1)]

9 - Ring gear [1)]

- Matched to drive pinion (gear set)
- Application according to transmission code letters

⇒ *Parts-catalog*

- Press off of housing using drift ⇒ Fig. 9
- Install on differential housing ⇒ Fig. 10

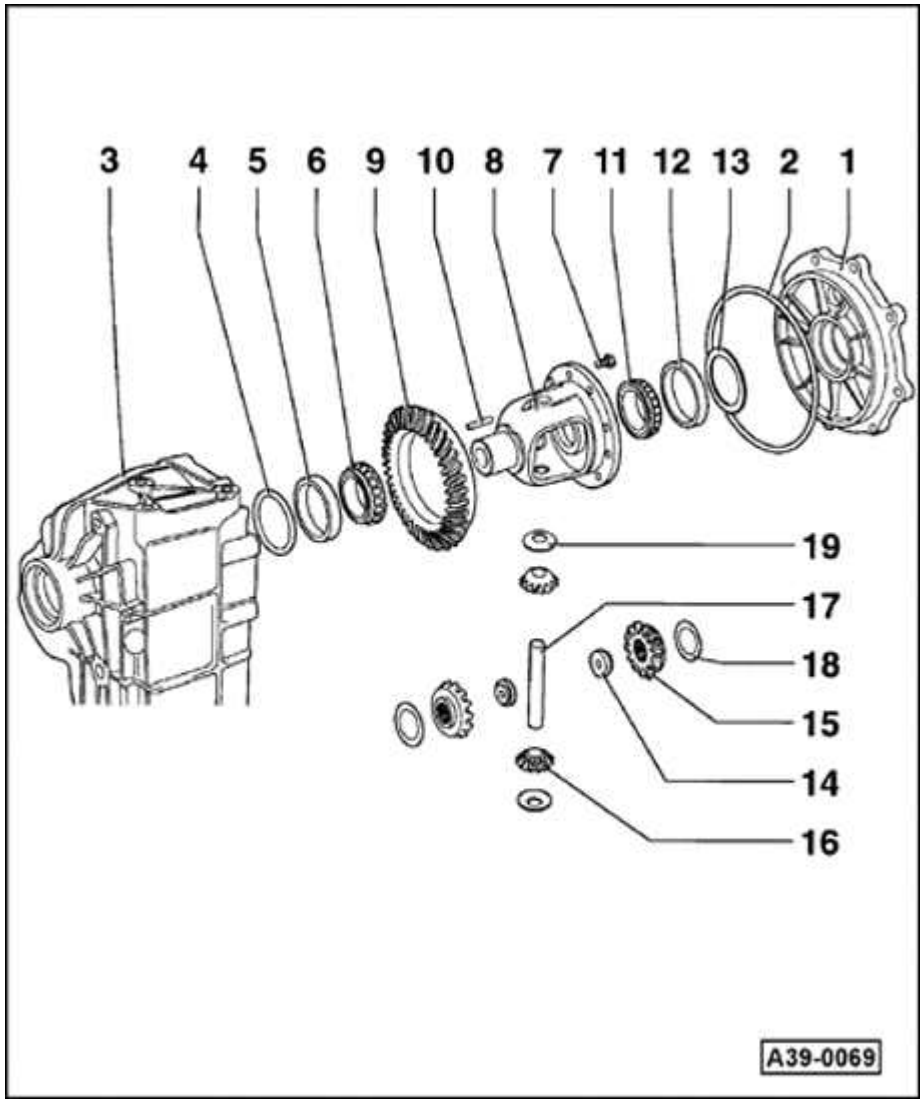
10 - roll pin

- For securing shaft for differential bevel gears
- Drive in flush

11 - Large tapered roller bearing inner race [1)]

- Pulling off ⇒ Fig. 5
- Pressing on ⇒ Fig. 6

39-142



12 - Large tapered roller bearing outer race [1)]

- Driving out ⇒ Fig. 7
- Pressing in ⇒ Fig. 8

13 - Adjustment shim "S1"

- Note thickness
- List of adjustments ⇒ page 39-170

14 - Threaded piece

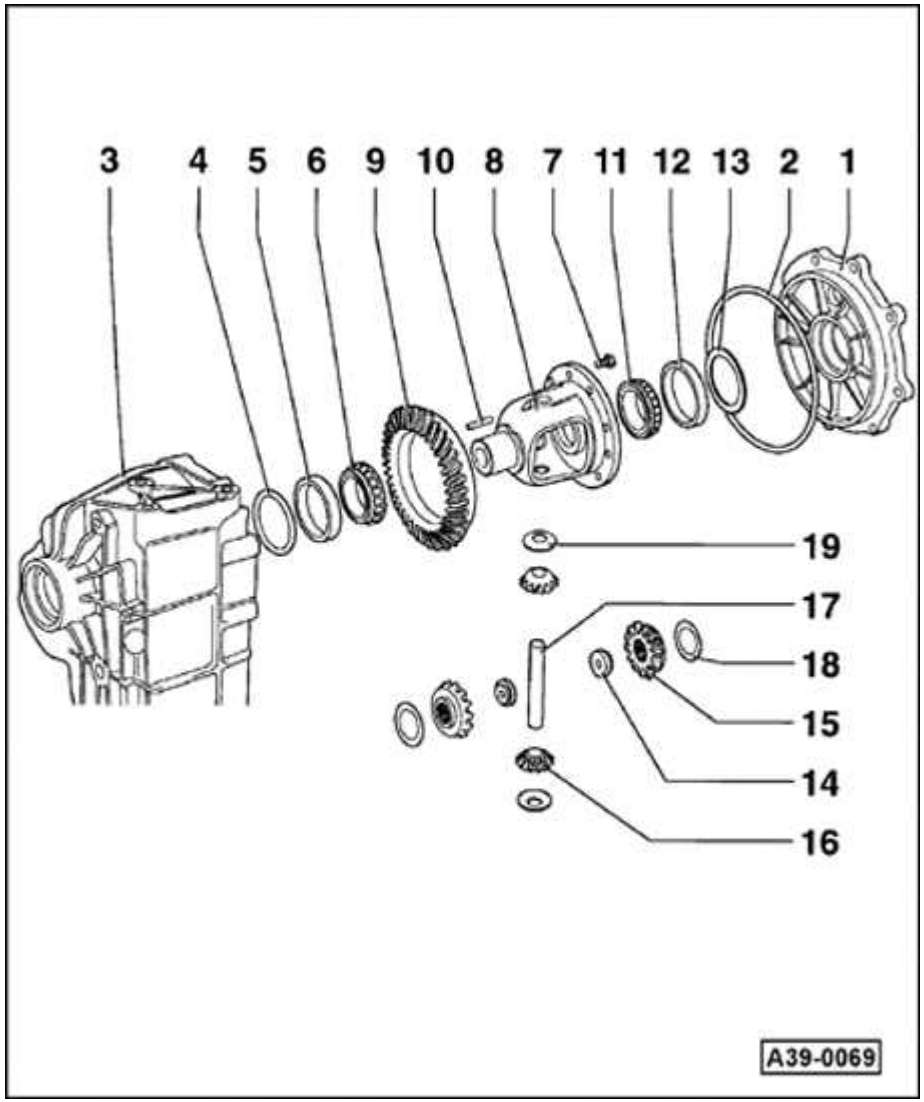
15 - Large differential bevel gear

- Installing ⇒ Fig. 11
- Adjusting ⇒ Fig. 12

16 - Small differential bevel gear

- Installing ⇒ Fig. 11

39-143



17 - Shaft for differential bevel gears

- Drive out using drift
- Drive in carefully so as not to damage thrust washers.
- Secure with locking pin -Item 10 -

18 - Adjustment shim

- Re-determine thickness ⇒ Fig. 12

19 - Thrust washer

- Check for cracks

39-144

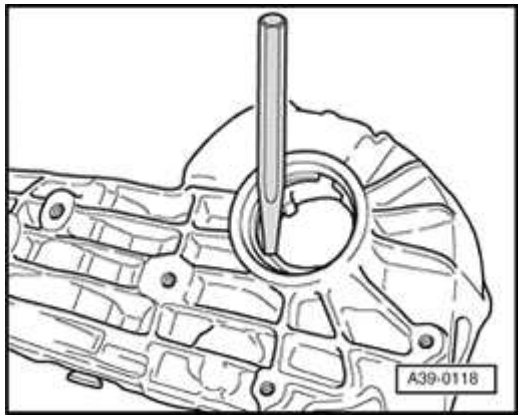


Fig. 1 Driving small tapered roller bearing outer race out of housing

- Check adjustment shims for damage after removing.

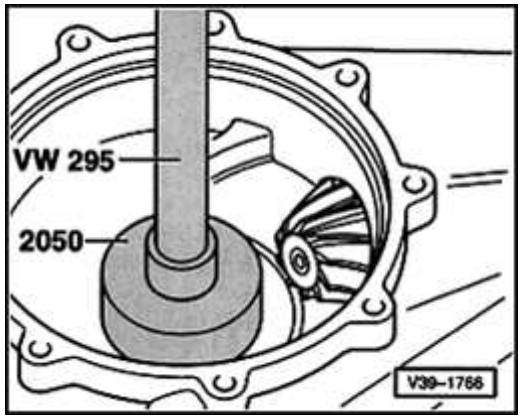


Fig. 2 Pressing tapered roller bearing outer race into housing

- Install outer race with VW295 needle bearing drift by tapping lightly using hammer.
- Then drive in to stop, as shown in illustration.

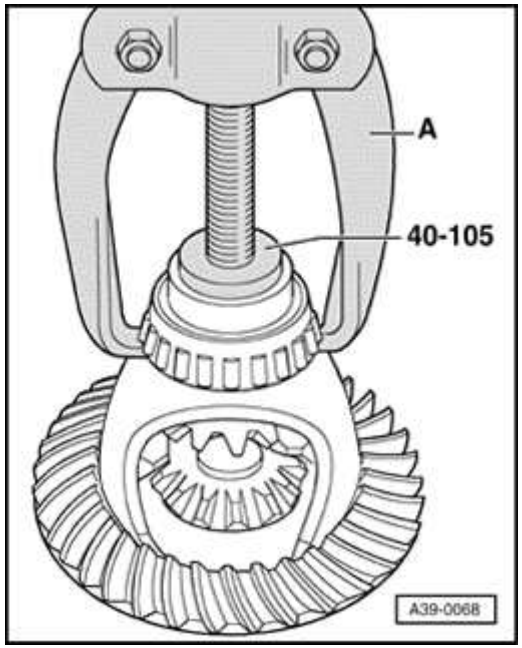


Fig. 3 Pulling off small tapered roller bearing inner race

A - Kukko 44/2 two-arm puller

39-146

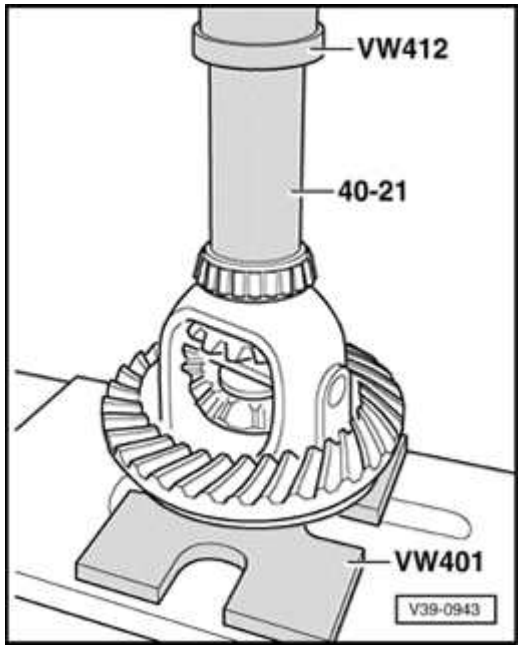


Fig. 4 Pressing on small tapered roller bearing inner race

WARNING!

Wear protective gloves!

- Heat inner race to approx. 100 °C ,position and press on.

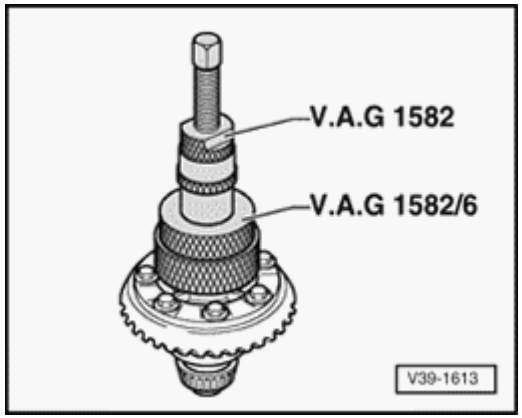


Fig. 5 Pulling off large tapered roller bearing inner race

- Before installing removal tool, set 40-105 thrust piece onto differential housing.

39-147

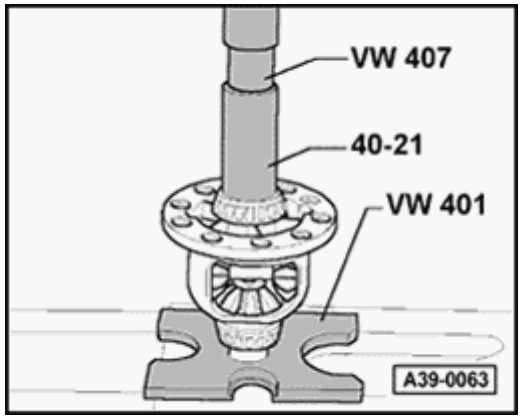


Fig. 6 Pressing on large tapered roller bearing inner race

WARNING!

Wear protective gloves!

- Heat inner race to approx. 100 °C ,position and press on.

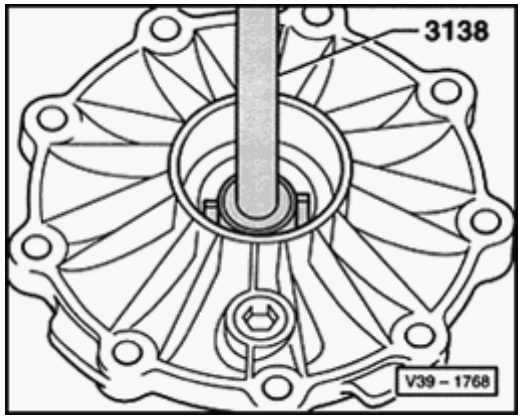


Fig. 7 Driving large tapered roller bearing outer race out of cover

- Check adjustment shims for damage after removing.

39-148

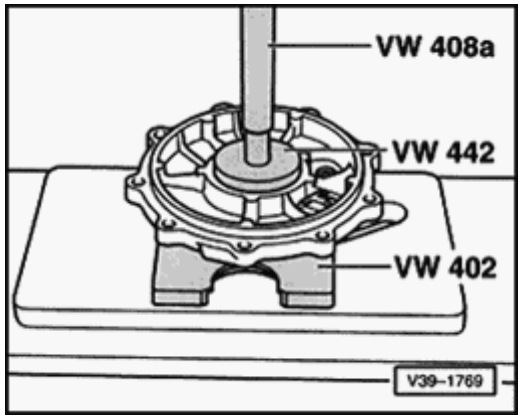


Fig. 8 Pressing large tapered roller bearing outer race into cover

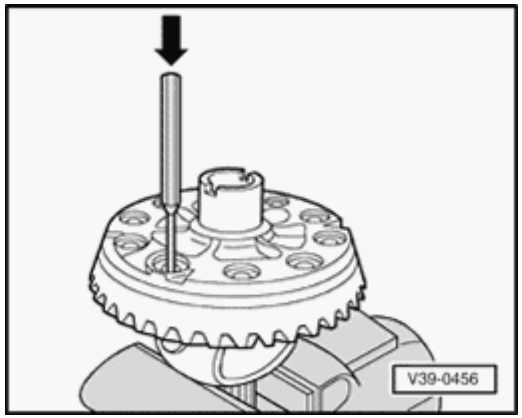


Fig. 9 Driving out ring gear from housing

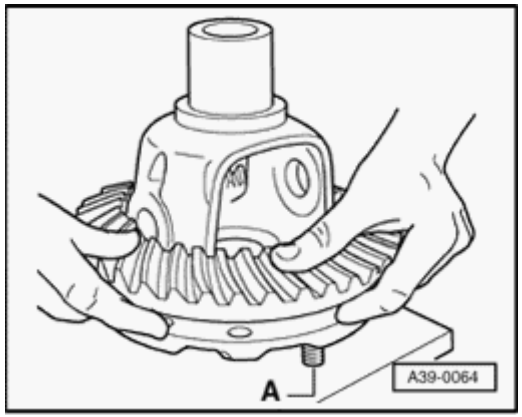


Fig. 10 Installing ring gear

WARNING!

Wear protective gloves!

- When installing ring gear, guide with centering pins -A- (self-made).
- Heat ring gear to approx. 100 ° C and position.

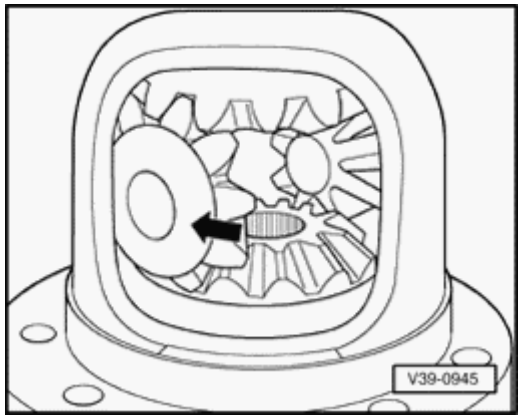


Fig. 11 Installing small differential bevel gears

- If the large differential bevel gears were replaced, adjustment shims must be re-determined ⇒ Fig. 12 .
- Insert large differential bevel gears with determined adjustment shims.
- Insert small differential bevel gears at 180 ° from their final position and rotate into place (arrow).
- Install thrust washers and locate.
- Install threaded pieces.
- Drive in differential bevel gear shaft to final position and secure.

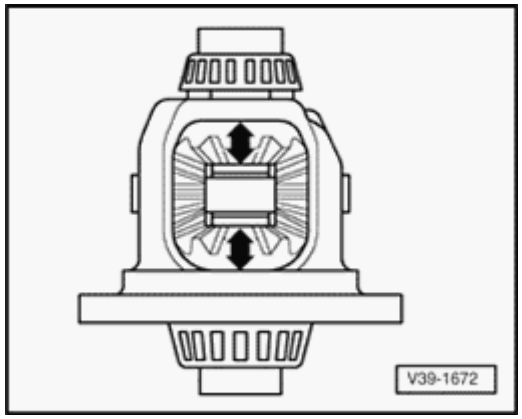


Fig. 12 Adjusting differential bevel gears

- Install large differential bevel gears with the thinnest shims (0.5 mm).
- Insert small differential bevel gears 180° from final position together with thrust washers.

Note:

Do not rearrange differential bevel gears and thrust washers again!

- Drive in shaft for differential bevel gears.
- Press the small differential bevel gears toward the outside.
- Push large differential bevel gears in direction of arrow and check play.
- Determine the largest possible shim that can still be installed for the large differential bevel gears on each side.
  - ♦ Adjustment shims should be the same thickness on both sides.
- Determine adjustment shims according to table. Part numbers

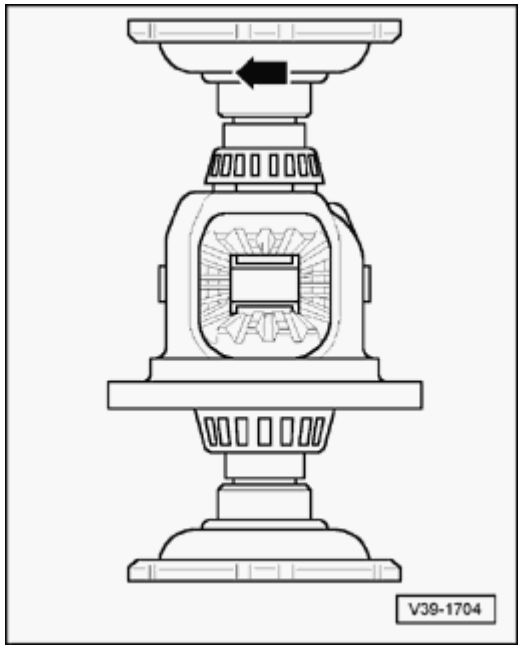
⇒ *Parts-catalog*

39-151

Available adjustment shims:

Shim thickness (mm)		
0.50	0.70	0.90
0.60	0.80	1.00

Note:



The adjustment is also correct when no more play can be felt, but the differential bevel gears can just barely be rotated (arrow).

39-146

Drive pinion and ring gear, adjusting

Note:

- *Careful adjustment of the drive pinion and ring gear is important for the service life and smooth running of the final drive. For this reason, the drive pinion and ring gear are matched together during manufacture, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is found by moving the drive pinion in an axial direction and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*

- *The object of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine in production.*

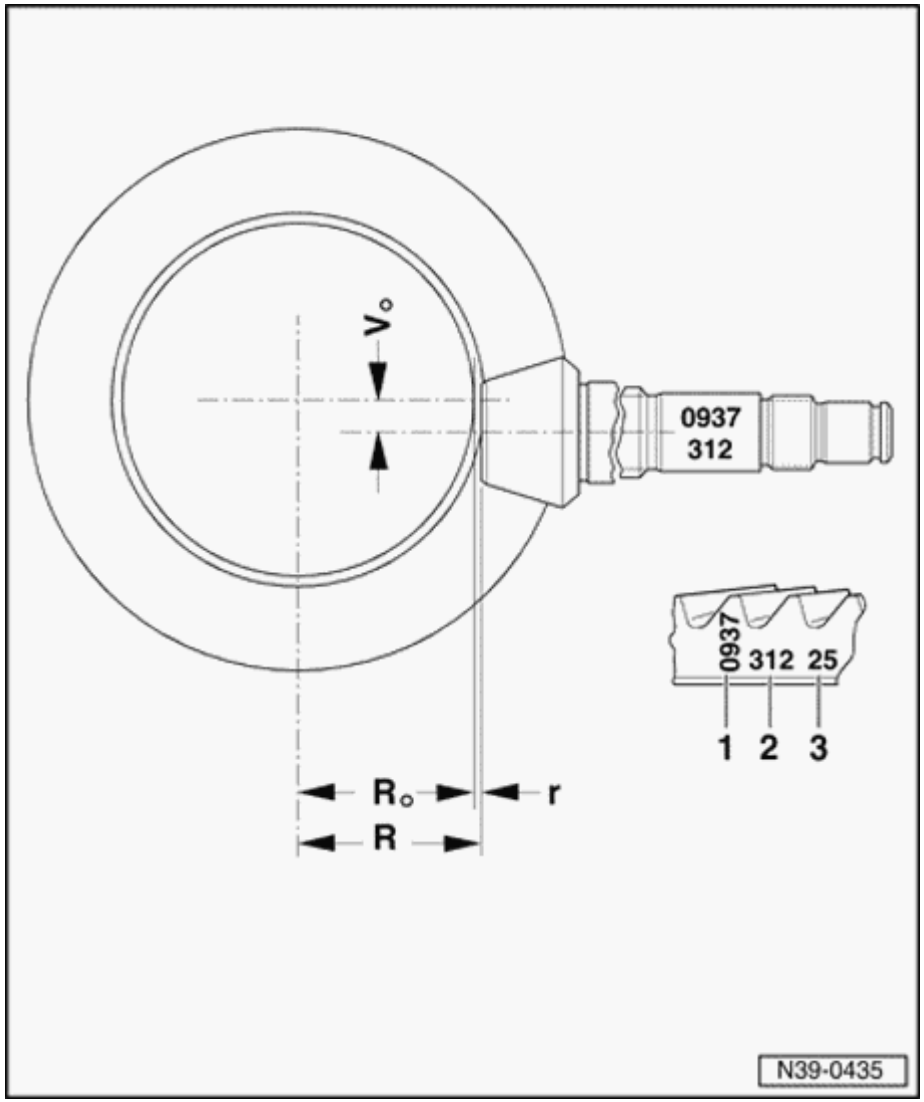
- *The deviation (tolerance) "r," which is related to the master gauge "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (drive pinion and ring gear) may only be replaced together as a matched pair.*

- *Observe the general repair instructions for*

tapered roller bearings and shims.

- *Maximum care and cleanliness are essential for achieving good results when performing repairs and taking measurements.*

39-147



Gear sets, adjusting and marking

1 - Identification "0937" signifies Oerlikon gear set with a ratio of 37:9.

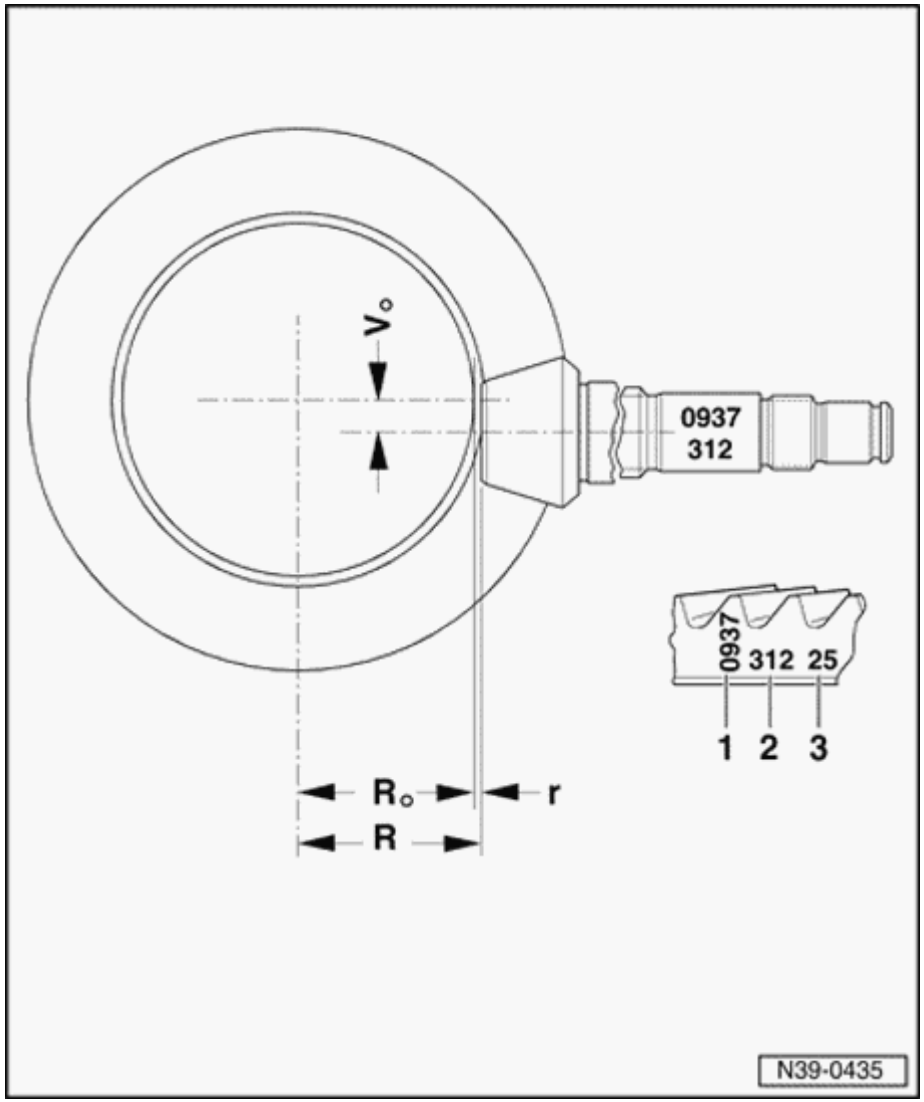
2 - Gear set pairing number (312).

3 - Deviation (tolerance) "r" is based on the test machine master gauge used in the production. The deviation "r" is always given in 1/100 mm. Example: "25" signifies r = 0.25 mm

Ro - Length of master gauge used for test machine "Ro."

Ro - Ring gear = 57.50 mm

39-148



R - Actual distance between center axis of ring gear and face of drive pinion at point with quietest running for this gear set. R = Ro + r

Vo - Hypoid offset

Readjusting final drive set, recommended sequence

The following work sequence is recommended to save time when the drive pinion and ring gear have to be adjusted:

1.) Determine total shim thickness "S_{total}" for "S1" + "S2" for the specified preload for tapered roller bearings for differential.

2.) Determine total shim thickness "S3" to reproduce the installation position for the drive pinion determined on the test machine in production.

3.) Distribute total shim thickness "S_{total}" for "S1" + "S2" so that the specified backlash exists between ring gear and drive pinion.

Note:

Overview of components and shims ⇒ *Page 39-151* .

Adjustment overview

Note:

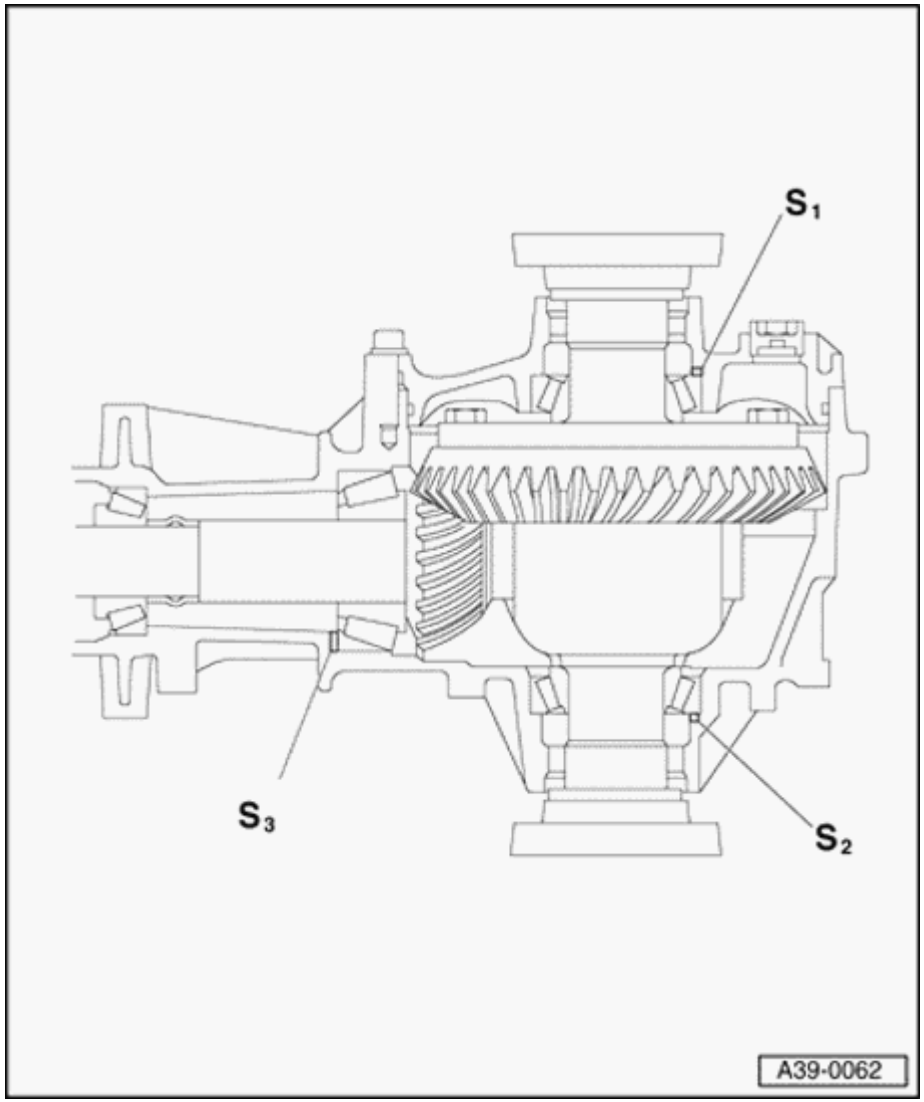
If repairs have been carried out on the final drive it is only necessary to adjust the drive pinion or final drive set if components have been replaced which have a direct effect on the adjustments of the final drive. Refer to the following table to avoid unnecessary adjustments:

	adjustment required:		
Part replaced: ▼	Ring gear "S1"+"S2" 1) ⇒ Page 39-163	Drive pinion "S3" 1) via deviation "r" ⇒ Page 39-154	Check backlash ⇒ Page 39-169
Final drive housing	X	X	X
Differential housing	X		X
Tapered roller bearing for drive pinion		X	X
Tapered roller bearing for differential	X		X
Final drive set 2)	X	X	X
Cover for final drive	X		X

1) Shims; installation position ⇒ Page 39-151 .

2) Drive pinion and ring gear; only replace together.

39-151



Shims, position

Note:

Adjustment overview when replacing individual components of final drive ⇒ *Page 39-150* .

S1 - Adjustment shim for ring gear in cover for final drive

S2 - Adjustment shim for ring gear in final drive housing

S3 - Adjustment shim for drive pinion in final drive housing

39-152

Special tools, testers and auxiliary items

- Dial gauge extension VW 382/10
- Universal mandrel VW 385/1
- Centralizing disc VW 385/2
- Centralizing disc VW 385/3
- Measuring plunger VW 385/14
- Dial gauge extension VW 385/15
- Measuring plate VW 385/17
- Master gauge VW 385/30
- End dimension plate VW 385/33
- Universal dial gauge bracket VW 387
- Measuring lever VW 388
- Press plate VW 401

- Press plate VW 402
- Press tool VW 408 A
- Support rails VW 457

39-153

- Ring gear adjusting appliance VW 521/4
- Ring gear adjusting appliance VW 521/8
- Engine and transmission support VW 540
- Thrust plate 30-205
- Installing ring 2003/3
- Pinion assembly appliance 2052/2
- Thrust plate 3005
- Retainer 3028
- Thrust pad 3062
- Fitting appliance 3253 with 3253/3 and 3253/4
- Retainer 3304
- Engine/transmission jack V.A.G 1383 A

- Universal support V.A.G 1359/2
- Dial gauge extension 30 mm
- Dial gauge
- Torque gauge 0-600 Ncm

39-154

Drive pinion, adjusting

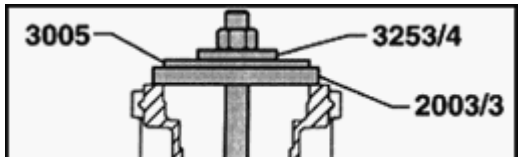
Note:

- *Before adjusting drive pinion, adjust ring gear (determine total shim thickness "S_{total}" for shims "S1" + "S2")* ⇒ *Page 39-163* .
- *The drive pinion only has to be readjusted if the final drive set (ring gear and drive pinion), the tapered roller bearings for the drive pinion or the final drive housing are replaced. Adjustment overview* ⇒ *Page 39-150* .
- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determine thickness of shim "S3"

(Setting preload of tapered roller bearings for drive pinion)

- Mount final drive onto engine and transmission support ⇒ Page 39-108 .

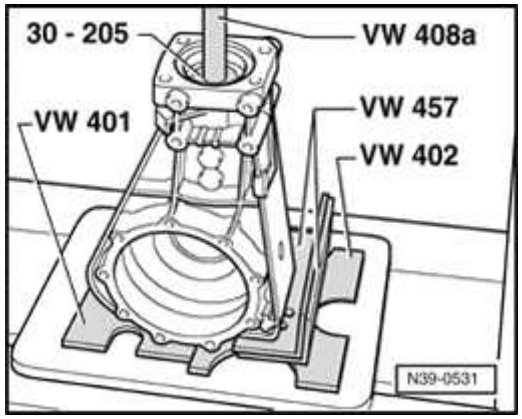


- Pull outer race of large tapered roller bearing into housing (without shim).

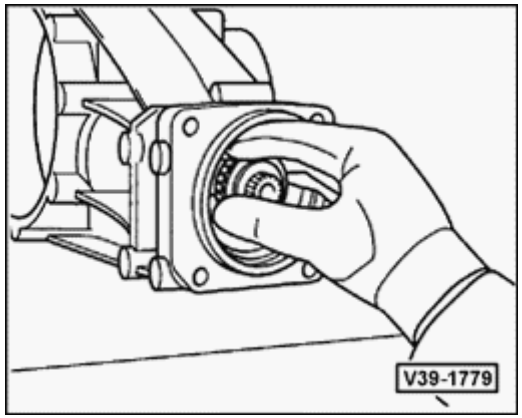
Note:

Inscription "Oben" with thrust washer 3253/4 faces the nut of the puller.

39-155



- Pull outer race for small tapered roller bearing into housing.
- Lubricate outer race with oil and fit using press tool VW 408 A and thrust plate 30-205.



- Insert drive pinion without spacer sleeve.

CAUTION!

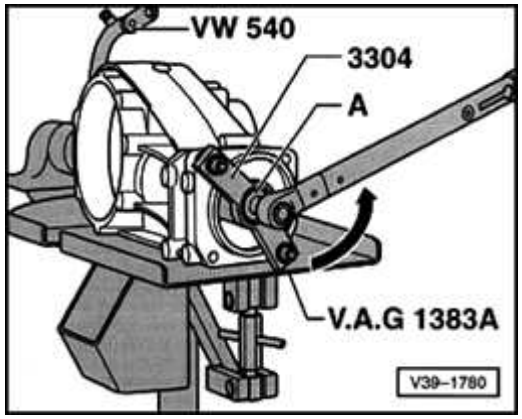
Wear protective gloves.

- Heat inner race for tapered roller bearing to approx. 100 ° C and fit onto drive pinion.

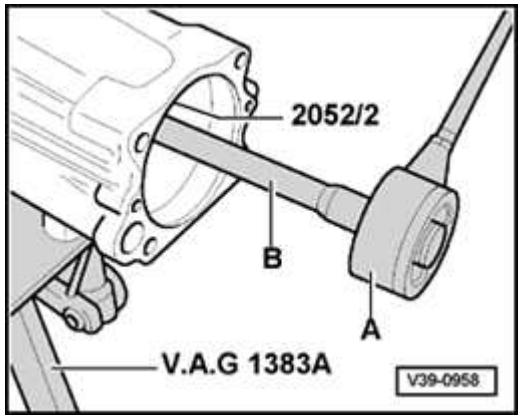
Note:

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *Only install spacer sleeve for final friction torque measurement (after determining shim "S3").*

39-156



- Secure retainer 3304 with two M8 x 30 hex bolts.
- Support final drive when tightening nut (e.g. using universal support V.A.G 1359/2 in conjunction with transmission jack V.A.G 1383 A).
- Fit a new drive pinion nut.
- Tighten drive pinion nut just far enough so that no play can be felt at drive pinion.
- Gradually increase tightening torque, checking friction torque at regular intervals, unti specified friction torque is obtained.



A - Torque gauge, commercially available, 0-600 Ncm

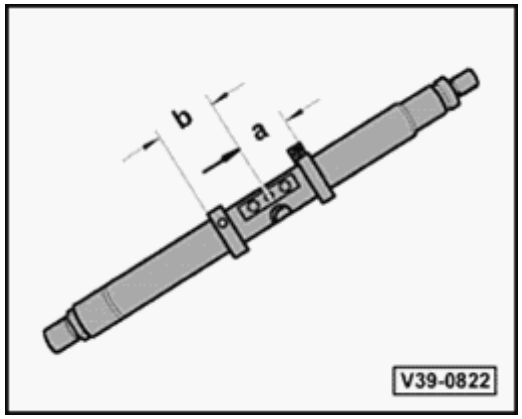
B - Extension with 32 mm socket

The following friction torques should be set:

New bearings	**Used bearings** [1)]
200-250 Ncm	30-60 Ncm

[1)] run at least 50 km (30 miles)

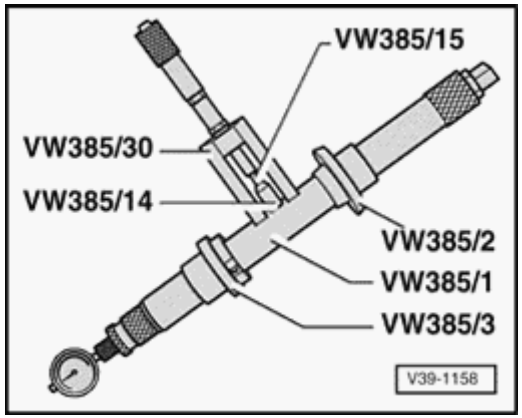
39-157



- Set adjustment ring of universal mandrel VW 385/1.

  Distance a = 60 mm
- Set sliding adjustment ring.

  Dimension b = 55 mm



- Assemble universal mandrel as illustrated:

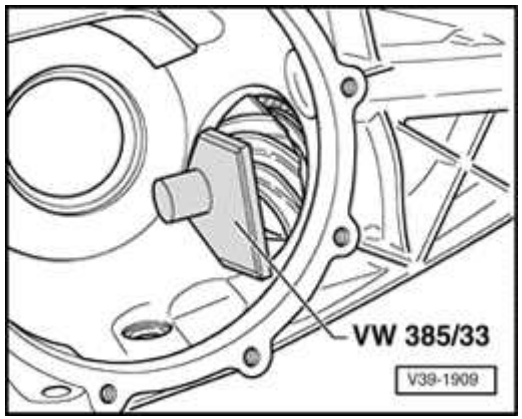
  Dial gauge extension VW 385/15 = 9 mm long
- Set universal master gauge VW 385/30.

  Ro = 57.50 mm
- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.

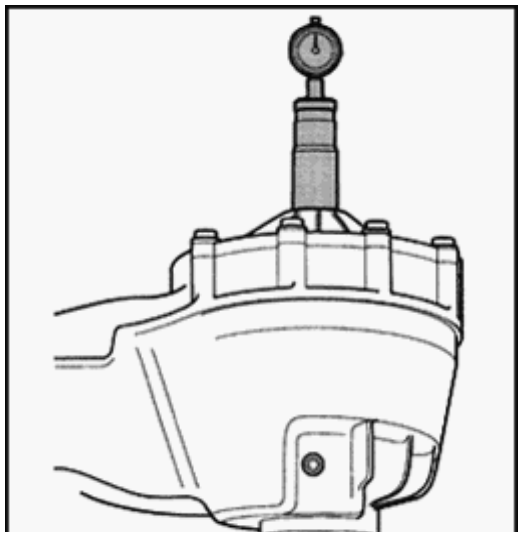
39-158

Note:

Before performing following measurements turn drive pinion at least five turns in both directions, so that the tapered roller bearings settle. Otherwise a false reading will be obtained.



- Place end measuring plate VW 385/33 onto drive pinion head.

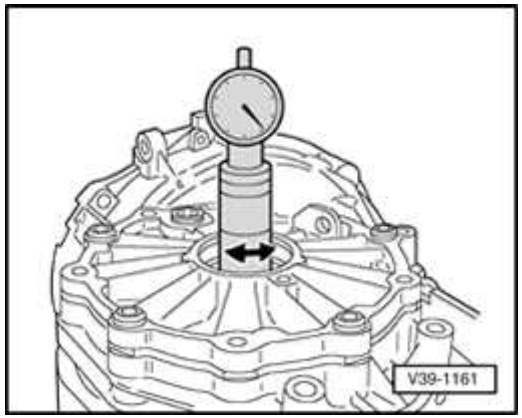


- Remove master gauge and insert measuring mandrel in the housing.

  The centering disc VW 385/3 faces toward cover for final drive

- Fit cover for final drive and tighten 4 bolts.
- Using adjustable ring, move 2nd centering disc out as far as possible so that mandrel can still just be turned by hand.

39-159



Determining measurement "e"

- Turn mandrel until dial gauge point touches end measuring plate on drive pinion head, then measure maximum deflection (return point). Measured value is dimension "e" (in red scale).
  - Measurement in following example: "e" = 1.60 mm

Note:

Dimension "e" is required to determine thickness of shim "S3."

- After removing universal mandrel, check once again whether dial gauge reads "0" with 2 mm preload when master gauge VW 385/30 is in place, otherwise repeat measurement.

Determining shim thickness "S3"

Formula:

"S3" = "e" - "r"

e = Measured value

r = Deviation (tolerance): marked on ring gear in 1/100 mm

Example:

	Determined value "e"	1.60 mm
-	Deviation "r"	0.42 mm
=	Thickness of shim "S3"	1.18 mm

- Determine shim(s) as accurately as possible from table.

⇒ *Parts catalog*

The following shims are available for "S3"

Shim thickness (mm) 1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

- Remove universal mandrel.

39-161

- Remove drive pinion and outer race of large tapered roller bearing and install together with measured shims "S3" and spacer sleeve ⇒ from Page 39-139 .

Install inner race of small tapered roller bearing and tighten nut for drive pinion until specified friction torque is obtained

⇒ *Fig. 11* , ⇒ Page 39-144 .

Note:

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- *Increase tightening torque slowly and check friction torque at regular intervals, if the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve which has been compressed too much cannot be reused.*

- Set to following friction torques:

New bearings	Used bearings 1)
200-250 Ncm	30-60 Ncm

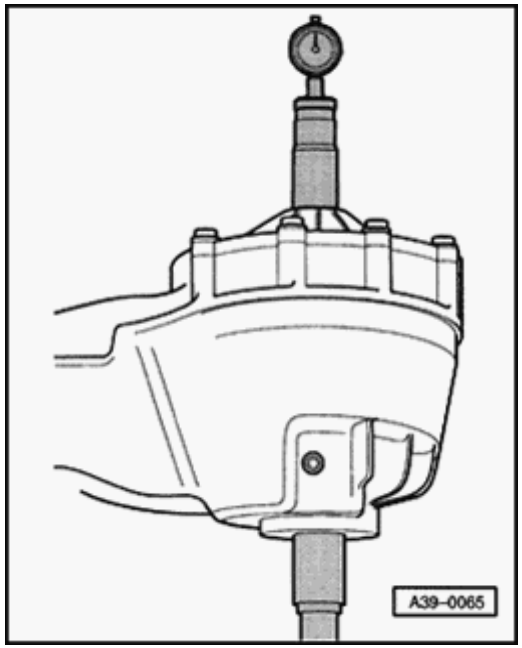
[1)] run at least 50 km (30 miles)

39-162

Performing check measurement

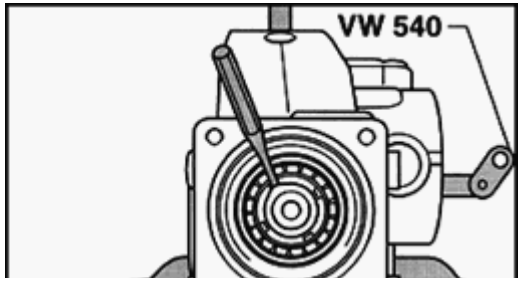
Checking dimension "r"

- Turn drive pinion at least 5 turns in both directions.



- Insert universal mandrel and perform check measurement.

  If the shims have been correctly selected, the dial gauge should now show the value of "r" as marked on the ring gear, reading anti-clockwise in the red scale, within a tolerance of ± 0.04 mm.



- Peen drive pinion nut with a punch.

39-163

Ring gear, adjusting

(Adjusting differential)

Repairs after which the ring gear has to be adjusted ⇒ Page 39-150 , Adjustment overview

Note:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "S_{total}."*

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determining total shim thickness "S_{total}" for shims "S1" + "S2"

(Setting preload of tapered roller bearing for differential)

- Drive pinion removed or ring gear dismantled from differential housing

- Pull out drive flange oil seal with lever.

- Remove differential tapered roller bearing outer races and take out shims ⇒ Page 39-120 .

Press outer race of left tapered roller bearing for differential (housing side) with shim "S2" into housing

⇒ *Fig. 2* , ⇒ Page 39-126 . To perform measurement use a shim "S2*" with a thickness of 1.00 mm (one 0.80 mm shim and one 0.20 mm shim).

Note:

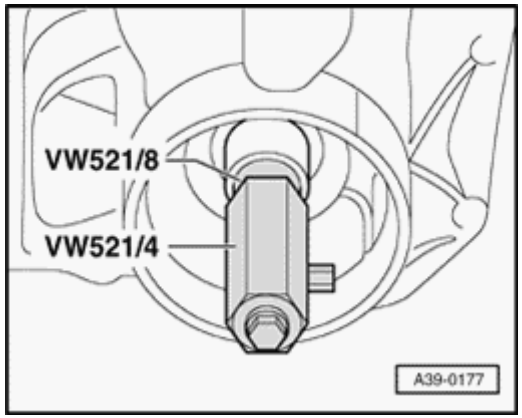
For measurement purposes a shim "S2" of 1.0 mm is initially inserted which will be designated "S2" in the following. After determining the backlash "S2*" will be replaced by the correct "S2.."*

-	Press in outer race of right tapered roller bearing for differential (final drive cover side) without shims	⇒ *Fig. 8* , ⇒ Page 39-120 (install as far as

the stop).

- Insert differential into housing. Ring gear is positioned on right side (cover side).

- Fit cover and tighten bolts to 25 Nm.

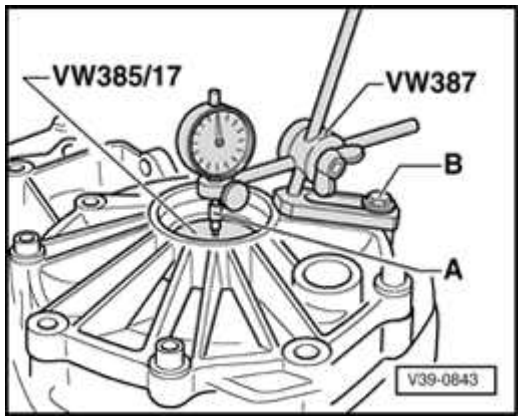


- Install special tools VW 521/4 and 521/8 onto housing side in differential housing.
- Turn cover side of differential housing upward.

39-165

- Turn differential 5 turns in both directions to settle tapered roller bearing.

- Place measuring plate VW 385/17 onto differential.



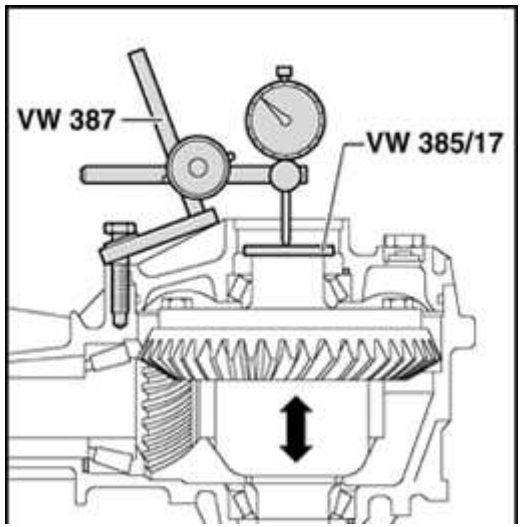
- Fit measuring tools.

A - Dial gauge extension approx. 30 mm long

B - Hex bolt M8 x 45

- Place D.T.I. extension on center of measuring plate VW 385/17.

- Set dial gauge (3 mm measuring range) to "0" with 2 mm preload.



- Lift differential without turning; read play on dial gauge and note.

  Measurement in following example: 0.50 mm

Note:

If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the tapered roller bearing.

39-166

Formula:

"S_{total}" = "S2*" + measurement + bearing preload

Example:

	Inserted shim(s) "S2*"	1.00 mm
+	Measured value	0.50 mm
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness "S_{total}" for shims "S1" + "S2"	1.80 mm

39-167

Determining thickness of shim "S1*"

Note:

- *The preliminary adjustment shim "S1*" will be replaced with the final shim "S1" after determining the backlash.*
- *The total shim thickness "S_{total}" remains unchanged.*

Formula:

"S1*" = "S_{total}" - "S2*"

Example:

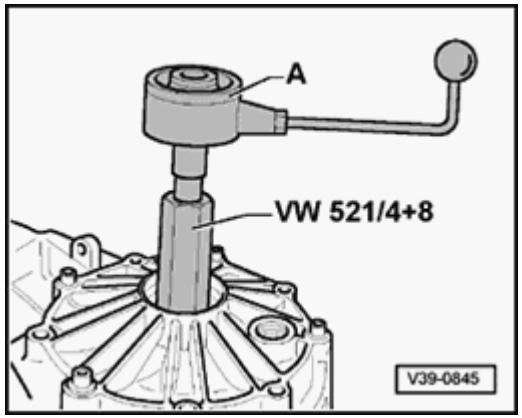
	Total shim thickness "S_{total}" for shims "S1" + "S2"	1.80 mm
-	Inserted shim(s) "S2*"	1.00 mm
=	Thickness of shim "S1*"	0.80 mm

- Determine shim(s) as accurately as possible from table ⇒ Page 39-172 .

39-168

Measuring friction torque (check)

- Drive pinion removed
- Differential fitted with shims "S1*" and "S2*"



- Fit torque gauge 0-600 Ncm -A- onto differential.
- Read friction torque.

Friction torque specifications:

New bearings	Used bearings 1)
150-300 Ncm	30-60 Ncm

1) run at least 50 km (30 miles)

Note:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness "S_{total}."*
- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *If the final drive set (drive pinion and ring gear) is being re-adjusted, the adjustment of the drive pinion should be performed now, and the*

adjustment checked ⇒ *Page 39-154* .

39-169

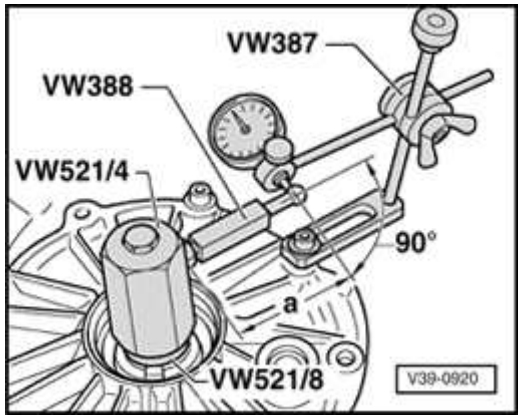
Adjusting backlash

(Positioning ring gear in final drive housing)

- Drive pinion with shim "S3" installed
- Differential with shims "S1*" + "S2*" installed

- Insert differential in final drive housing, install cover and tighten all bolts to 25 Nm.

- Turn differential 5 turns in both directions to settle tapered roller bearings.



- Assemble measuring equipment.

  Use dial gauge extension VW 382/10 (6 mm flat).

- Set measuring lever VW 388 to dimension "a" = 60 mm.
- Determine play between teeth flanks as follows:
  - Turn ring gear until it makes contact with a tooth flank (end of backlash travel).
  - Set dial gauge to "0" with 1 mm preload.

- Turn ring gear back until lying against an opposite tooth flank (backlash).

- Read backlash and note value.

- Turn ring gear through 90° and repeat measurements a further 3 times.

Note:

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

Determining average backlash

Example:

	1st measurement	0.28 mm
+	2nd measurement	0.30 mm
+	3rd measurement	0.30 mm
+	4th measurement	0.28 mm
=	Sum of measured values	1.16 mm

- Result: The average backlash is 1.16 ÷ 4 = 0.29 mm

Determining thickness of shim "S2"

Formula:

"S2" = "S2*" - backlash + lift

Example:

	Inserted shim "S2*"	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim "S2"	0.86 mm

- Determine shim(s) as accurately as possible from table.

⇒ *Parts catalog*

The following shims are available for "S2"

Shim thickness (mm) 1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

1) Using the shim tolerance variations it is

possible to find the exact shim thickness required, insert two shims if necessary.

39-172

Determining thickness of shim "S1"

Formula:

"S1" = "S_{total}" - "S2"

Example:

	Total shim thickness "S_{total}" for "S1" + "S2"	1.80 mm
-	Thickness of shim "S2"	0.86 mm
=	Thickness of shim "S1"	0.94 mm

- Determine shim(s) as accurately as possible from table. Part numbers

⇒ *Parts catalog*

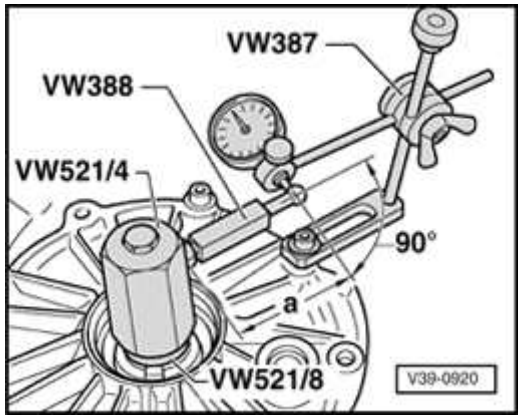
The following shims are available for "S1"

Shim thickness (mm) 1)		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20

0.40	0.80	

[1)] Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

39-173



Performing check measurement

- Drive pinion with shim "S3" installed
- Differential with shims "S1" + "S2" installed

- Turn differential 5 turns in both directions so that tapered roller bearings settle.
- Measure backlash four times on circumference.
  - Specifications: 0.12-0.22 mm

Note:

- *If the backlash lies outside the tolerances, the adjustments must be repeated, but the total shim thickness "S_{total}" must remain unchanged.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

39-146

Pinion shaft and ring gear, adjusting

Notes:

- *Careful adjustment of the pinion shaft and ring gear is important for the service life and smooth running of the final drive. For this reason, the pinion shaft and ring gear are matched together during manufacturing, and checked to ensure a good mesh pattern and quiet running in both directions of rotation. The position of quietest running is attained by moving the pinion shaft in an axial direction and at the same time lifting the ring gear out of the zero-play mesh position by the amount necessary to maintain the backlash within the specified tolerance.*

- *The objective of the adjustment is to reproduce the setting for quietest possible running, as obtained on the test machine during production.*

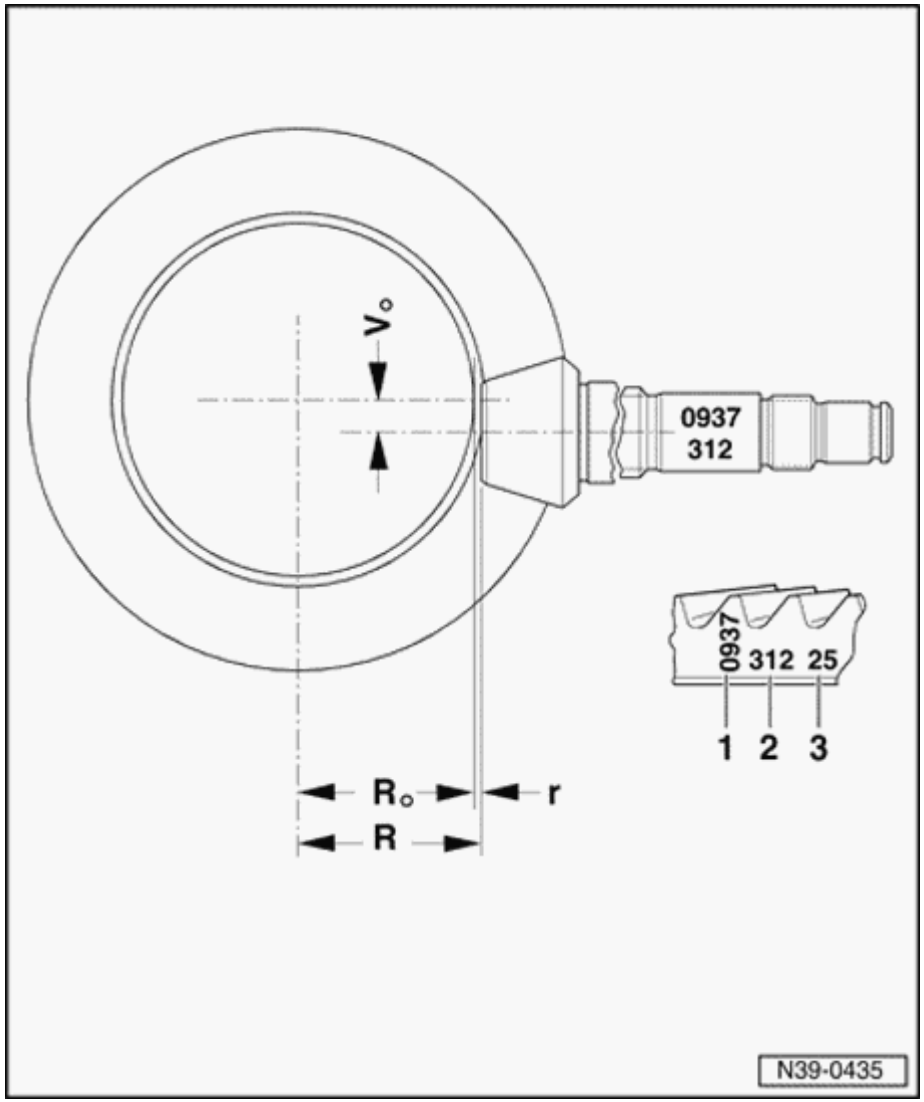
- *The deviation, or tolerance "r", which is related to the master gauge-adjustable "Ro" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. The final drive set (pinion shaft and ring gear) may only be replaced together as a matched pair.*

- *Observe general repair instructions for tapered*

roller bearings and shims.

- *Maximum care and cleanliness are essential for achieving good results during repairs and taking measurements.*

39-147



Adjustment and marking of gear sets

1 - Identification "0937" signifies an Oerlikon gear set with a ratio of 37:9

2 - Gear set pairing number (312)

3 - Deviation (tolerance) "r" is based on the test machine master gauge-adjustable used during production. Deviation "r" is always given in 1/100 mm. Example: 25 signifies "r" = 0.25 mm

Ro - Length of master gauge-adjustable used on test machine "Ro"

Ro - Ring gear = 57.50 mm (2.263 in.)

R - Actual dimension between center axis of ring gear and face of pinion shaft at point with quietest running for this gear set. R = Ro + r

Vo - Hypoid offset

Final drive gear set, recommended sequence for adjusting

If the pinion shaft and ring gear have to be re-adjusted, the following sequence is recommended for maximum efficiency:

1.) Determine total shim thickness Stotal for S1 + S2 for the specified tension of the tapered roller bearing for differential.

2.) Determine total shim thickness S3, so that pinion shaft obtains the specified installed position determined by the test machine in production.

3.) Split up total shim thickness Stotal for S1 + S2, so that the specified torsional backlash exists between ring gear and pinion shaft.

Note:

Overview of components and shims ⇒ *Page 39-149* .

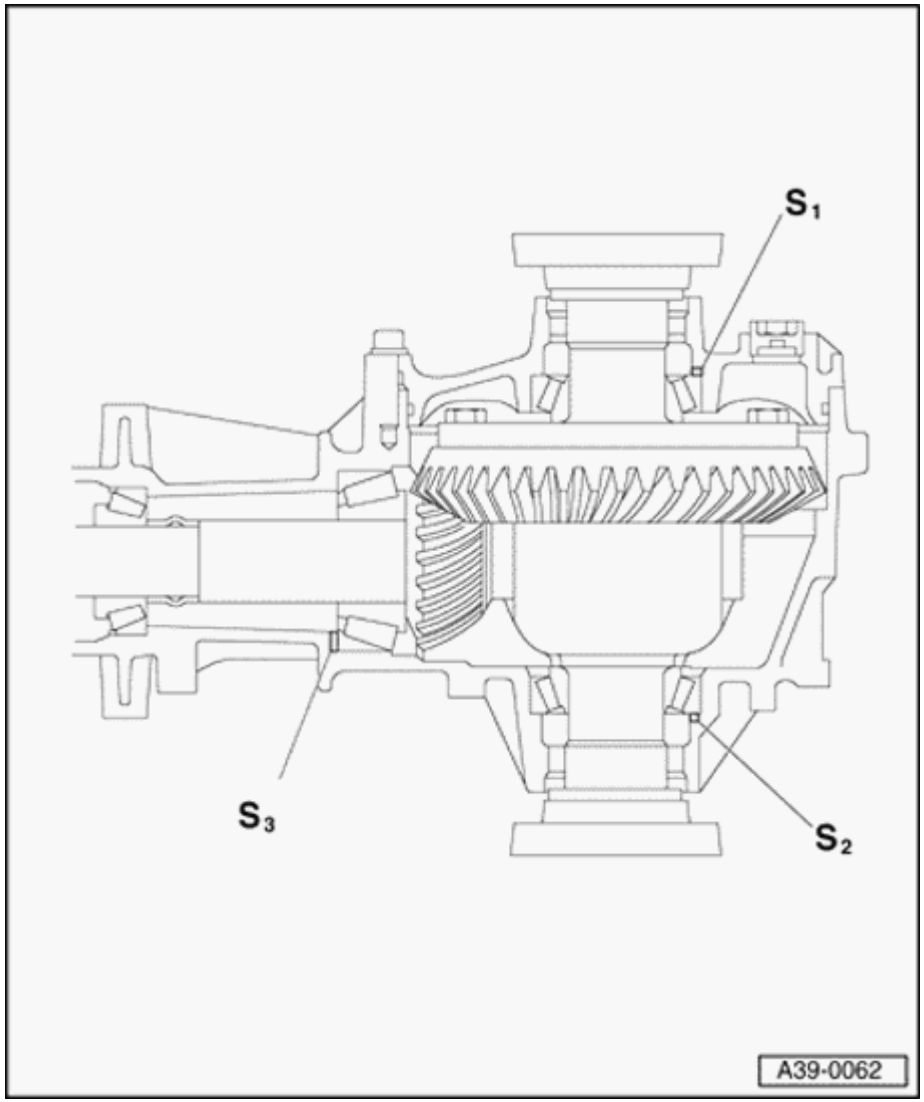
List of adjustments

Note:

If repairs have been carried out on the final drive, it is only necessary to adjust the pinion shaft or final drive set if components which have a direct effect on the adjustment of the final drive have been replaced. Observe the following table to avoid unnecessary adjustments:

Component to be adjusted: **Component being replaced:**	Ring gear (S1 + S2)1) ⇒ Page 39-162	Pinion shaft (S3)1) via deviation "r" ⇒ Page 39-153	Backlash checking ⇒ Page 39-168
Final drive housing	X	X	X
Differential housing	X		X
Tapered roller bearing for pinion shaft		X	X
Tapered roller bearing for differential	X		X
Final drive gear set2)	X	X	X
Final drive cover	X		X
1) Shims, installation position ⇒ Page 39-150 .			
2) Pinion shaft and ring gear, only replace together.			

39-150



Position of shims

Note:

List of adjustments when replacing individual components of final drive ⇒ *Page 39-149* .

S1 - Shim for ring gear in final drive cover

S2 - Shim for ring gear in final drive housing

S3 - Shim for pinion shaft in final drive housing

39-151

Special tools and equipment

- VW382/10 extension pin
- VW385/1 universal mandrel
- VW385/2 centering disc
- VW385/3 centering disc
- VW385/14 measuring rod
- VW385/15 extension pin
- VW385/17 measuring plate
- VW385/30 master gauge-adjustable
- VW385/33 end dimension plate
- VW387 dial indicator holder
- VW388 measuring lever
- VW401 thrust plate

- VW402 thrust plate
- VW408A punch
- VW457 support channels

39-152

- VW521/4 adjustment for ring gear
- VW521/8 adjustment for ring gear
- VW540 engine and transmission support
- 30-205 thrust pad
- 2003/3 mounting ring
- 2052/2 assembly tool for pinion shaft
- 3005 thrust pad
- 3028 retainer
- 3062 thrust pad
- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 bracket
- VAG1383A engine/transmission

- VAG1359/2 universal mount
- Dial indicator extension 30 mm
- Dial indicator
- Torque gauge 0-600 Ncm (53 in. lb)

39-153

Pinion shaft, adjusting

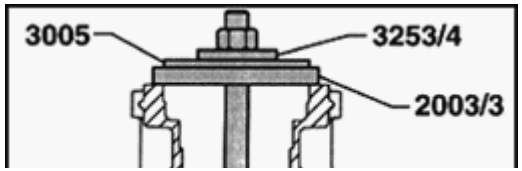
Notes:

- *Adjust the ring gear before adjusting the pinion shaft (determine total shim thickness Stotal for shims S1 + S2)* ⇒ *Page 39-162* .
- *The pinion shaft only has to be readjusted if the final drive gear set (pinion shaft and ring gear), tapered roller bearings for pinion shaft or the final drive housing are replaced. List of adjustments* ⇒ *Page 39-149* .
- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determine thickness of shim "S3"

Setting preload of tapered roller bearing for pinion shaft

- Mount rear final drive to repair stand ⇒ Page 39-110 .

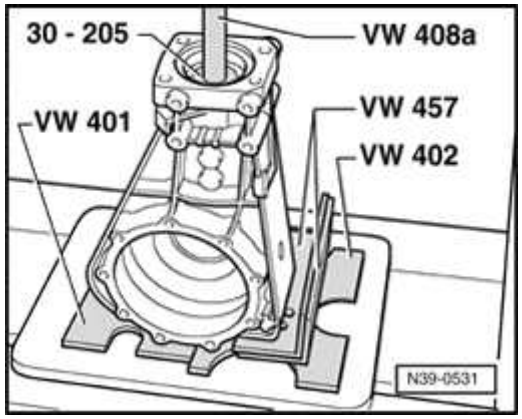


- Install large tapered roller bearing outer race into housing without shim.

Note:

The marking "Oben" on 3253/4 thrust piece faces the nut of the puller.

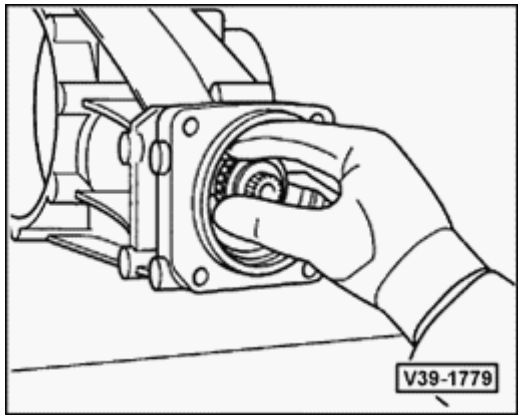
39-154



- Install small tapered roller bearing outer race into housing.
- Lubricate outer race with oil and install using VW408A punch and 30-205 thrust pad.
- Insert pinion shaft without spacer sleeve.

WARNING!

Wear protective gloves.

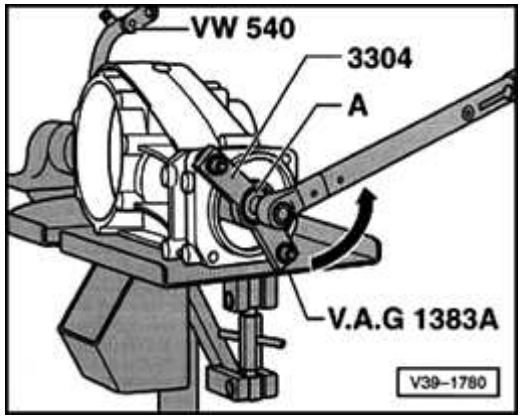


- Heat tapered roller bearing inner race to approx. 100 ° C (212 ° F) and install onto pinion shaft.

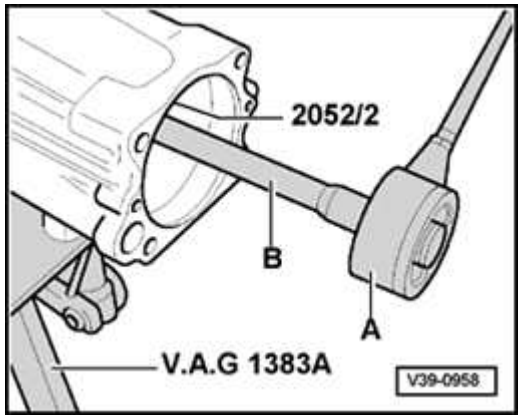
Notes:

- *Do not additionally oil new tapered roller bearings for friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *Install spacer sleeve only for final friction torque measurement (after determining shim S3).*

39-155



- Bolt on 3304 bracket with two hex-head bolts M8 x 30.
- Differential must be supported when tightening nut (e.g. using VAG1359/2 universal mount and transmission hoist VAG1383A).
- Replace pinion shaft nut.
- Tighten pinion shaft nut, until no play can be felt on pinion shaft.
- Increase tightening torque until specified friction torque is attained, measuring friction torque several times during this process.



A - Torque gauge, 0-600 Ncm (commercially available)

B - Socket extension, 36 mm

- Adjust friction torque as follows:

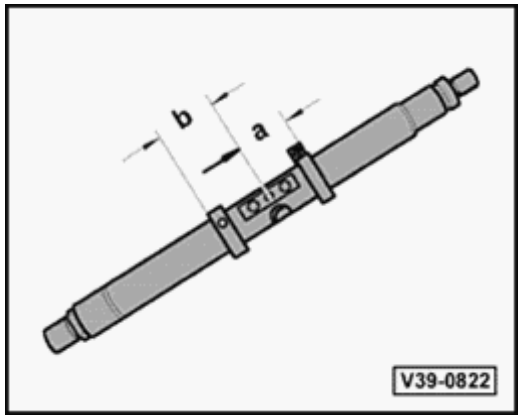
New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

1) Must have run at least 50 km (30 miles)

Note:

If the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.

39-156

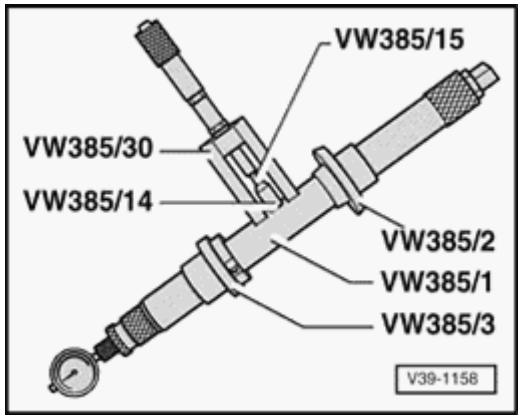


- Set adjustment ring of VW385/1 universal mandrel.

Dimension -a-: 60 mm (2.36 in.)

- Set sliding adjustment ring.

Dimension b: 55 mm (2.16 in.)



- Assemble universal mandrel as illustrated:

VW385/15 dial indicator extension = 9 mm long

- Set VW 385/30 master gauge-adjustable.

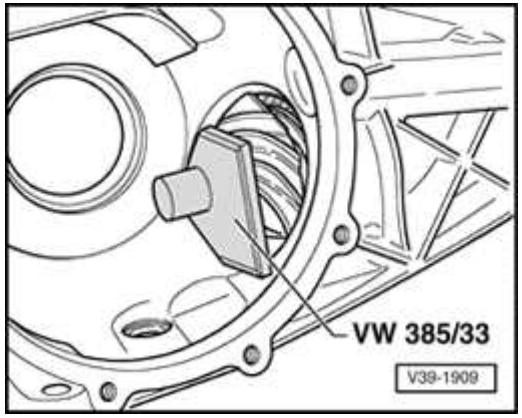
Ro = 57.50 mm (2.266 in.)

- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.

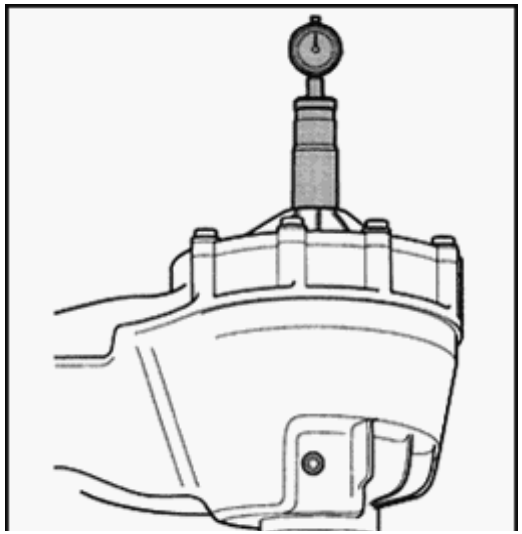
39-157

Note:

Before carrying out following measurements turn pinion shaft at least five turns in both directions, so that the tapered roller bearings settle. Otherwise a false reading will be obtained.



- Place VW 385/33 end dimension plate onto pinion shaft head.

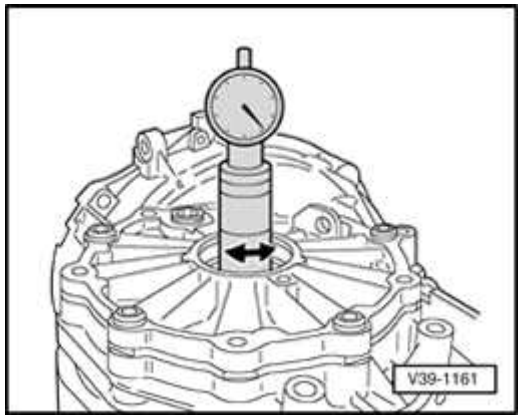


- Remove master gauge-adjustable and insert measuring mandrel in housing.

  385/3 centering disc faces final drive cover

- Install final drive cover and tighten 4 bolts.
- By turning adjustable ring, move 2nd centering disc out until mandrel can still just be turned by hand.

39-158



Determining measurement "e"

- Turn mandrel until dial indicator point touches end measuring plate on pinion shaft head, then measure maximum runout (return point). Measured value is dimension"e"(red scale).

Measurement in following example: e = 1.60 mm

Note:

Dimension "e" is required to determine thickness of shim S3.

- After removing universal mandrel, and with VW385/30 master gauge-adjustable in place, check once again whether dial indicator reads "0" with 2 mm preload, otherwise repeat measurement.

Determining shim thickness "S3"

Formula:

S3 = e - r

e = Measured value

r = Deviation (tolerance): marked on ring gear in 1/100 mm

Example:

	Measured value e	1.60 mm
-	Deviation r	0.42 mm
=	Thickness of shim S3	1.18 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S3"

Shim thickness (mm)1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	

1) By using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

- Remove universal mandrel.

- Remove pinion shaft and large tapered roller bearing outer race and install together with measured shims S3 and spacer sleeve ⇒ Page 39-139 .

- Install small tapered roller bearing inner race and tighten nut for pinion shaft until specified friction torque is obtained ⇒ Page 39-144, Fig. 11 .

Notes:

- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

- *Increase tightening torque gradually and check friction torque at regular intervals, if the specified friction torque is exceeded, the spacer sleeve must be replaced and the adjustment repeated. A spacer sleeve that has been over-compressed at any time cannot be reused.*

- Adjust to following friction torques:

New bearings	Used bearings1)
200-250 Ncm (18-22 in. lb)	30-60 Ncm (3-5 in. lb)

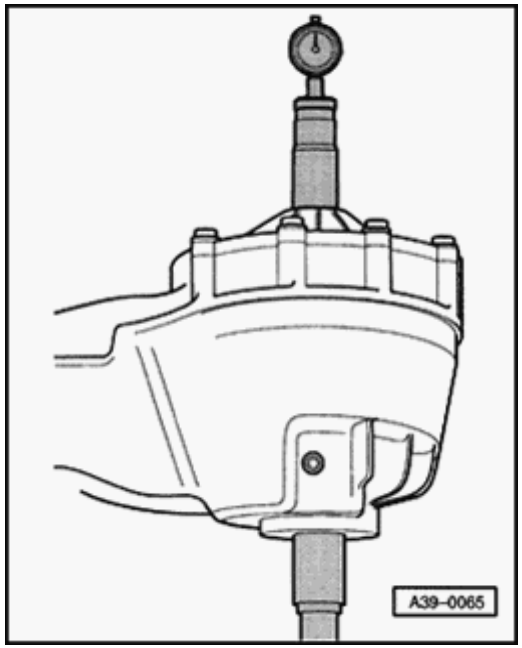
[1)] Must have run at least 50 km (30 miles)

39-161

Checking measurements

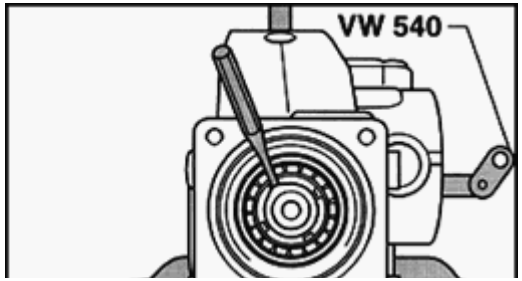
Checking dimension "r"

- Turn pinion shaft at least 5 turns in both directions.



- Insert universal mandrel and carry out check measurement.

If the shims have been correctly selected, the dial indicator should now display the value of "r" as marked on the ring gear, reading counterclockwise (red scale), within a tolerance of ± 0.04 mm.



- Secure pinion shaft nut using mandrel.

Ring gear, adjusting

Adjusting differential

The ring gear must be adjusted if any of the components have been replaced ⇒ table, ⇒ Page 39-149 .

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*

- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*

Determining total shim thickness "Stotal" for shims S1 + S2

(Setting preload of tapered roller bearing for differential)

- Pinion shaft removed or ring gear removed from differential housing.

- Pry out drive flange seal using pry bar.

- Remove differential tapered roller bearing outer races and remove shims ⇒ Page 39-121 .

- Press left tapered roller bearing outer race for differential (housing side) with shim S2 into housing ⇒ Page 39-126, Fig. 2 . To perform the measurement use shim S2* with thickness of 1.00 mm (one 0.80 mm shim and one 0.20 mm shim).

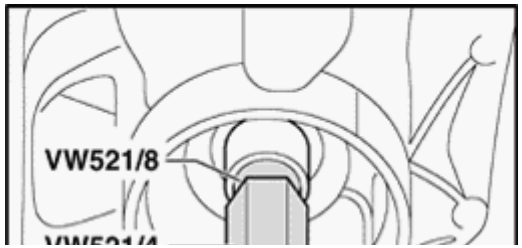
Note:

For measurement specification, a shim S2 of 1.0 mm thickness is initially inserted which will be designated S2 in the following. After determining the backlash S2* will be replaced by the correct shim S2.*

- Press in right tapered roller bearing outer race for differential (final drive cover side) without shims, until stop ⇒ Fig. 8, Page 39-130 .

- Insert differential into housing. Ring gear is positioned on right side (cover side).

- Install final drive cover and tighten bolts to 25 Nm (18 ft lb).

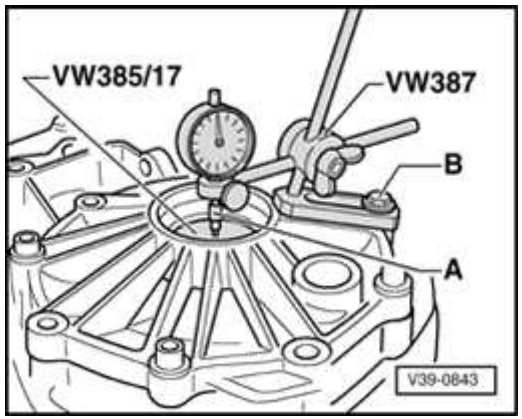


- Install special tools VW521/4 locking sleeve and 521/8 bushing on housing side into differential housing.
- Turn final drive housing so final drive cover faces upward.

39-164

- Turn differential 5 turns in both directions to settle tapered roller bearing.

- Place VW385/17 magnetic plate onto differential.

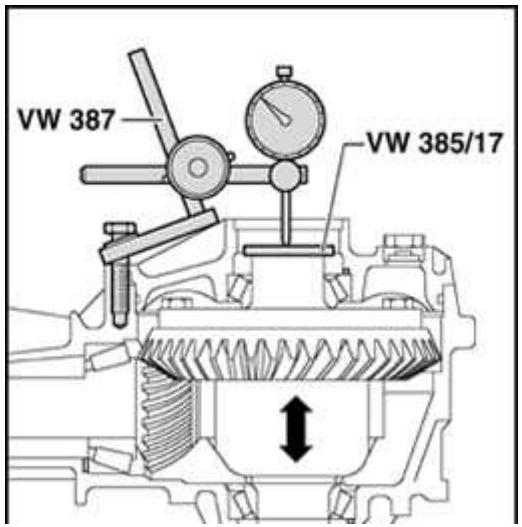


- Install measuring tools.

A - Dial indicator extension approx. 30 mm long

B - Hex-head bolt M8 x 45

- Place dial indicator extension on center of VW385/17 magnetic plate.
- Set dial indicator (3 mm measuring range) to "0" with 2 mm preload.



- Lift up differential without turning; read off play on dial indicator and note.

  Measurement in following example: 0.50 mm

Note:

If the measurement has to be repeated, the differential must again be turned 5 turns in each direction to settle the tapered roller bearing.

39-165

Formula:

Stotal = S2* + measurement + bearing preload

Example:

	Inserted shim(s) S2*	1.00 mm
+	Measured value	0.50 mm
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness Stotal for shims S1 + S2	1.80 mm

Determining thickness of shim "S1*"

Notes:

- *The preliminary shim S1* will be replaced with the final shim S1 after determining the backlash.*
- *The total shim thickness Stotal remains unchanged.*

Formula:

S1* = Stotal - S2*

Example:

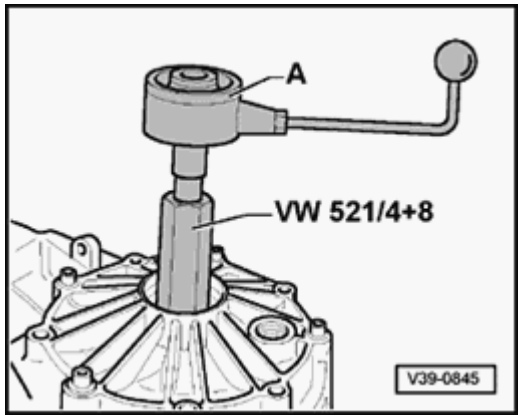
	Total shim thickness Stotal for shims S1 + S2	1.80 mm
-	Inserted shim(s) S2*	1.00 mm
=	Thickness of shim S1*	0.80 mm

- Determine shim(s) according to table ⇒ Page 39-171 .

39-167

Measuring friction torque

- Pinion shaft removed
- Differential with shims S1* and S2* installed



- Install torque gauge, 0-600 Ncm (53 in. lb)-A- onto differential.
- Read value of dial indicator.

Friction torque specifications:

New bearings	Used bearings1)
150-300 Ncm (13-27 in. lb)	30-60 Ncm (3-5 in. lb)
1) Must have run at least 50 km (30 miles)	

Notes:

- *Differential tapered roller bearings are low friction bearings. Therefore the friction torque only has a limited use as a check. Correct adjustment is only possible by determining the total shim thickness Stotal.*
- *Do not additionally oil new tapered roller bearings for the friction torque measurement. The bearings have already been treated with a special oil by the manufacturer.*
- *If the final drive gear set (pinion shaft and ring gear) is being re-adjusted, the adjustment of the pinion shaft should be checked* ⇒ *Page 39-153* *.*

39-168

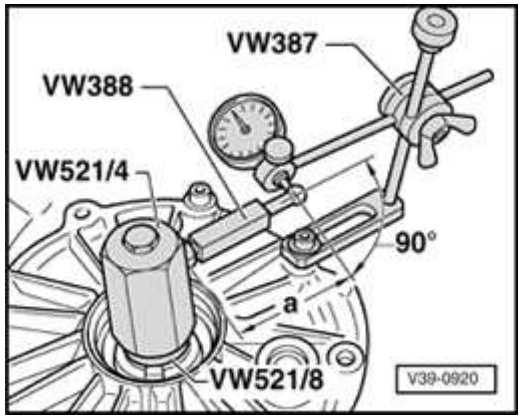
Adjusting backlash

Position of ring gear in final drive housing

- Pinion shaft with shim S3 installed
- Differential with shims S1* + S2* installed

- Insert differential into final drive housing, install final drive cover and tighten all bolts to 25 Nm (18 ft lb).

- Turn differential 5 turns in both directions to settle tapered roller bearings.



- Assemble measuring equipment.
- Use VW382/10 dial indicator extension (6 mm flat).
- Set VW388 measuring lever to dimension -a-

  Dimension -a-: 60 mm.
- Determine play between teeth flanks as follows:
  - Turn ring gear until it makes contact with tooth flank (end of backlash travel).
  - Set dial indicator to "0"with 1 mm preload.

- Turn ring gear back until contact is made against opposite tooth flank (backlash).

- Read value of dial indicator and note.

- Turn ring gear 1/2-turn (90 °) each time and repeat measurements 3 times.

CAUTION!

If the individual measurements differ by more than 0.06 mm from each other, the installation of the ring gear or the final drive set itself is not correct. Check installation, replace final drive set if necessary.

Determining average backlash

Example:

	1st measurement	0.28 mm
+	2nd measurement	0.30 mm
+	3rd measurement	0.30 mm
+	4th measurement	0.28 mm
=	Sum of measured values	1.16 mm

- Result: the average backlash is 1.16 mm ÷ 4 = 0.29 mm

Determining thickness of shim "S2"

Formula:

S2 = S2* - backlash + lift

Example:

	Inserted shim S2*	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim S2	0.86 mm

- Determine shim(s) according to table. Part numbers ⇒ parts catalog

The following shims are available for "S2"

Shim thickness (mm)1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required, insert two shims if necessary.

Determining thickness of shim "S1"

Formula:

-S1- = Stotal - S2

Example:

	Total shim thickness Stotal for S1 + S2	1.80 mm
-	Thickness of shim S2	0.86 mm
=	Thickness of shim S1	0.94 mm

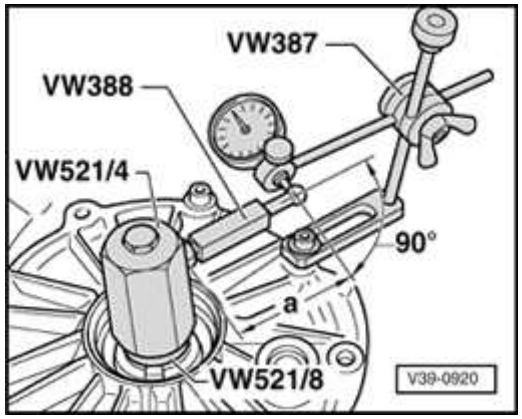
- Determine shim(s) according to table. Part numbers ⇒ parts catalog.

The following shims are available for "S1"

Shim thickness (mm)1)		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20
0.40	0.80	

1) Using the shim tolerance variations it is possible to find the exact shim thickness required,

insert two shims if necessary.



Checking measurements

- Pinion shaft with shim S3 installed
- Differential with shims S1 + S2 installed

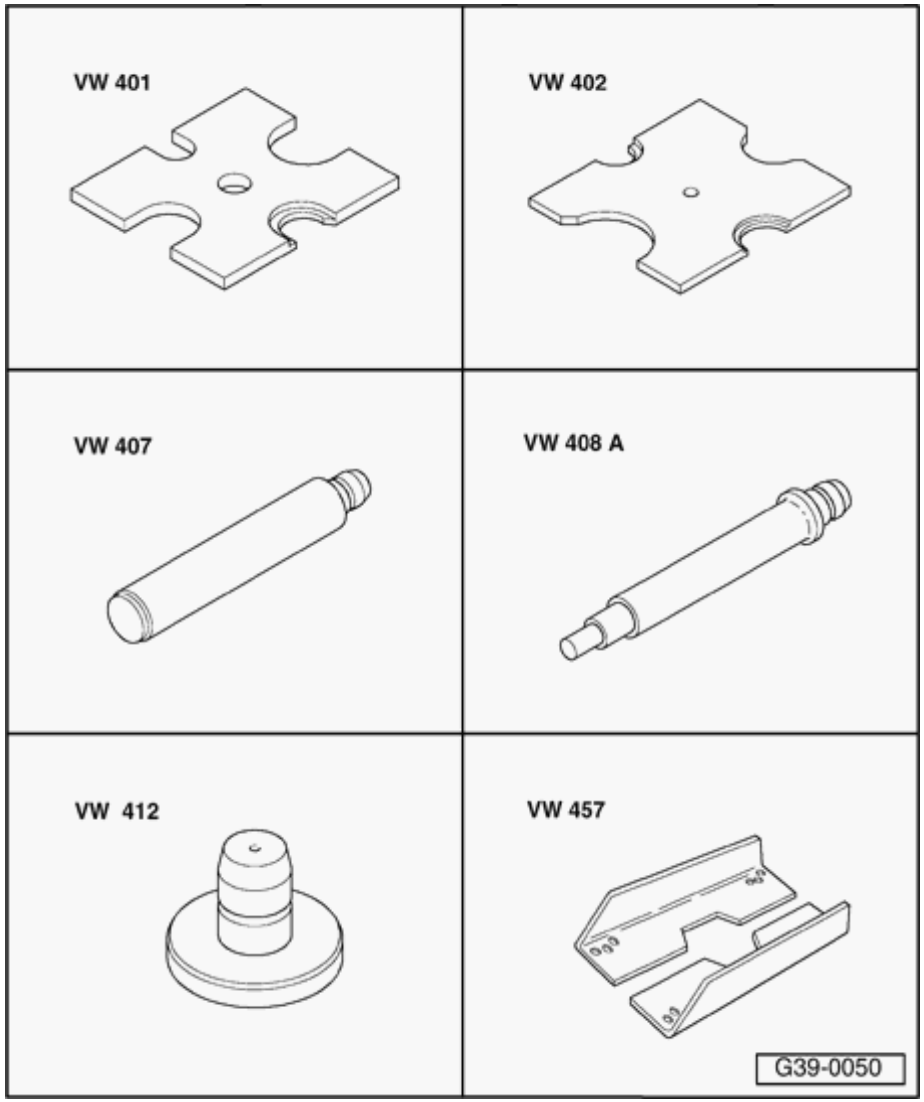
- Turn differential 5 turns in both directions to settle tapered roller bearings.
- Measure backlash four times on circumference.

  Specifications: 0.12-0.22 mm

Notes:

- *If the backlash lies outside the tolerance, the adjustment must be repeated, but the total shim thickness Stotal must remain unchanged.*
- *The individual measurements must not differ by more than 0.06 mm from each other.*

39-152

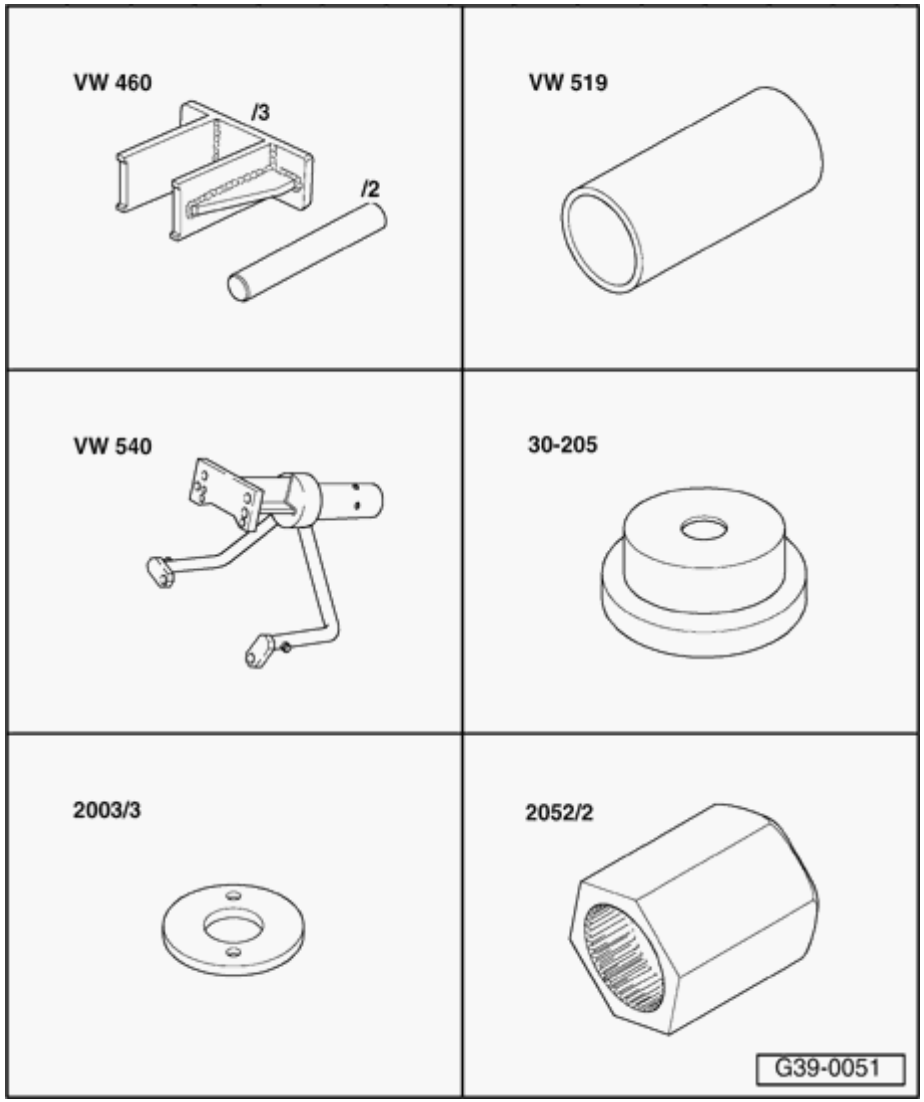


Drive pinion, removing, installing, disassembling and assembling

Special tools and equipment

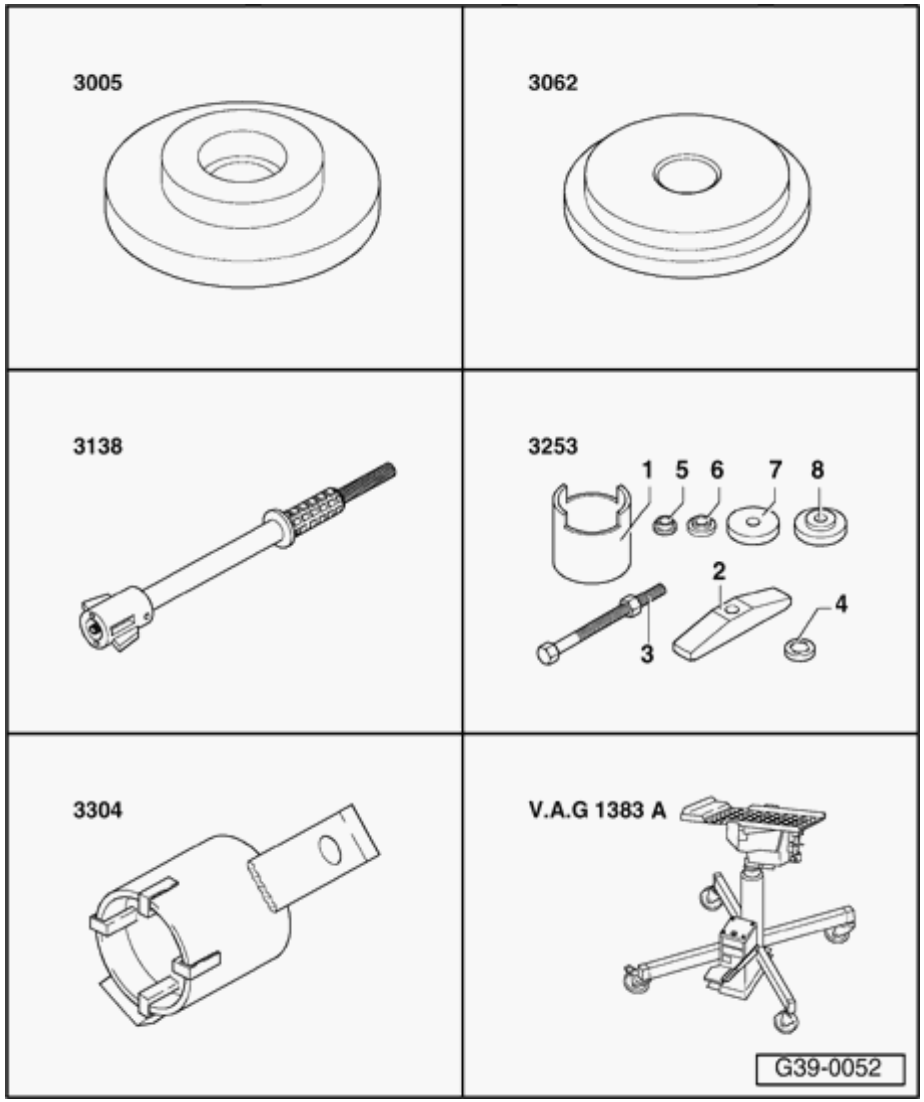
- VW401 thrust plate
- VW402 thrust plate
- VW407 punch
- VW408A punch
- VW412 punch
- VW457 support channels

39-153



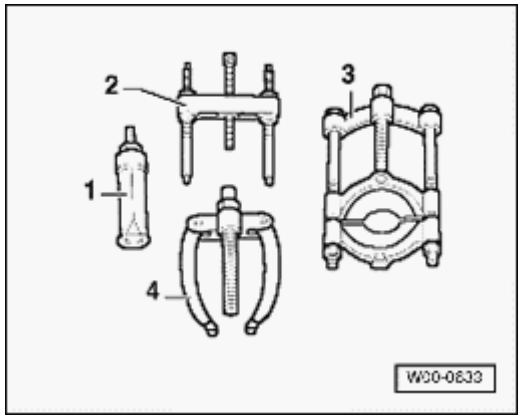
- VW460/2 drift
- VW 519 sleeve
- VW540 holding fixture
- 30-205 thrust pad
- 2003/3 seal installer
- 2052/2 assembly tool for drive pinion

39-154



- 3005 thrust pad
- 3062 thrust pad
- 3138 drift
- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 retainer
- Engine/transmission jack VAG1383A engine/gearbox jack

39-155

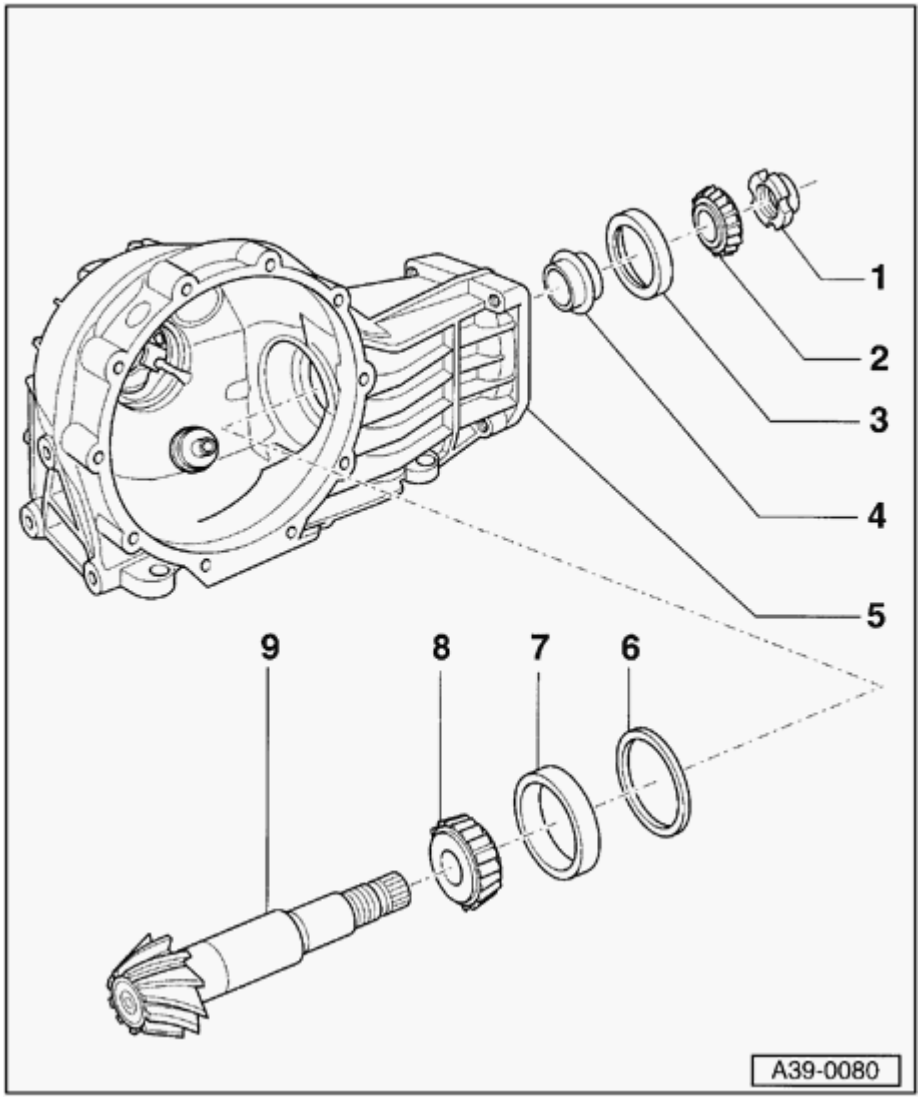


- Item 1: Kukko21/7 extractor
- Item 2: Kukko 22/2 support
- Item 3: Kukko 17/2 separator
- Torque gauge 0 - 600 Ncm
- 32 wrench insert hex socket

Notes:

- *General repair notes ⇒ page 00-27 .*
- *Disconnect torque tube from rear final drive with the final drive installed ⇒ page 39-96 .*
- *Disconnect torque tube from rear final drive with the final drive removed ⇒ page 39-126 .*
- *Replace both tapered roller bearings together. If possible, use same manufacturer!*
- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*
- *Removing differential ⇒ page 39-128 .*
- *Adjustments are required when replacing components marked with 1) ⇒ Adjustment overview ⇒ page 39-170 .*

39-157



1 - Nut

- Always replace
- Unbolt ⇒ Fig. 1 and Fig. ⇒ 2
- Unbolt ⇒ Fig. 11
- Measuring friction torque ⇒ Fig. 12
- Secure ⇒ Fig. 13

2 - Small tapered roller bearing inner race 1)

- Press out drive pinion ⇒ Fig. 3
- Pressing on ⇒ Fig. 10

3 - Small tapered roller bearing outer race 1)

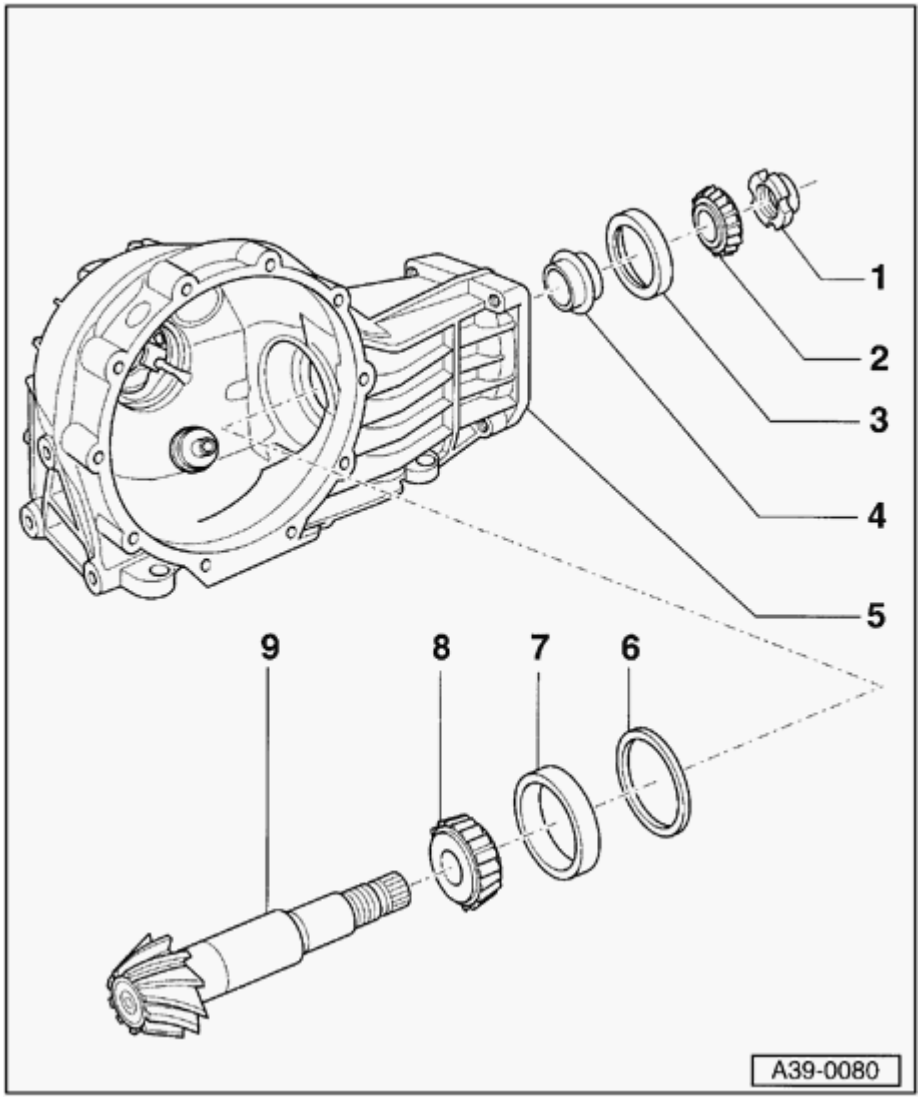
- Pulling out ⇒ Fig. 4
- Pressing in ⇒ Fig. 9

4 - Spacer sleeve 1)

- Always replace

5 - Final drive housing 1)

39-158



6 - Shim "S3"

- Note thickness
- Adjustment overview ⇒ page 39-170

7 - Large tapered roller bearing outer race 1)

- Driving out ⇒ Fig. 5
- Pulling in ⇒ Fig. 8

8 - Large tapered roller bearing inner race 1)

- Pressing off ⇒ Fig. 6
- Pressing on ⇒ Fig. 7

9 - Drive pinion 1)

- Matched to ring gear, always replace together as a set

39-159

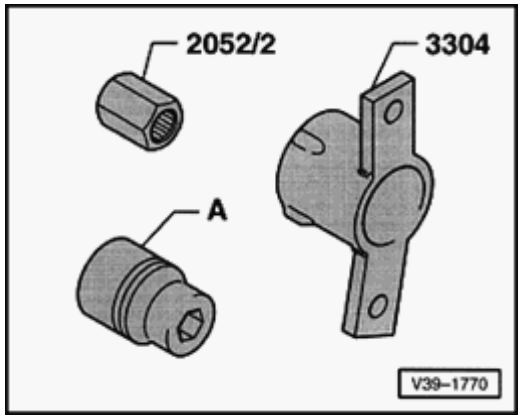


Fig. 1 Tools for removing and installing drive pinion nut

A - 32 mm wrench socket

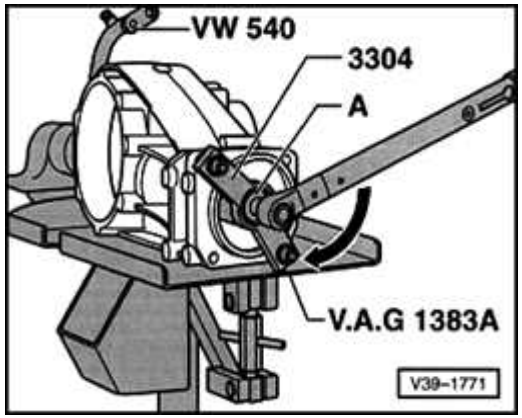


Fig. 2 Removing drive pinion nut

- Install 3304 retainer using two hex bolts M8 x 30.
- When nut is removed, final drive must be supported (e.g. using VAG1359/2 universal mount together with VAG1383A transmission hoist).

39-160

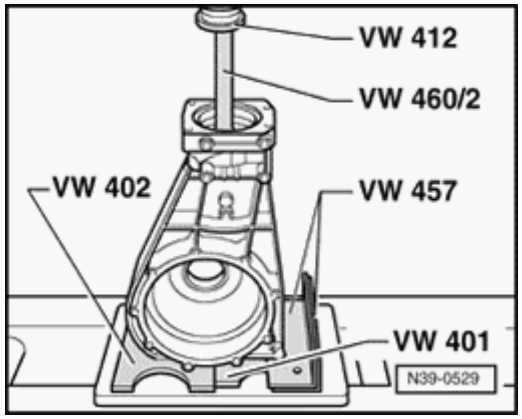


Fig. 3 Pressing out drive pinion from small tapered roller bearing inner race

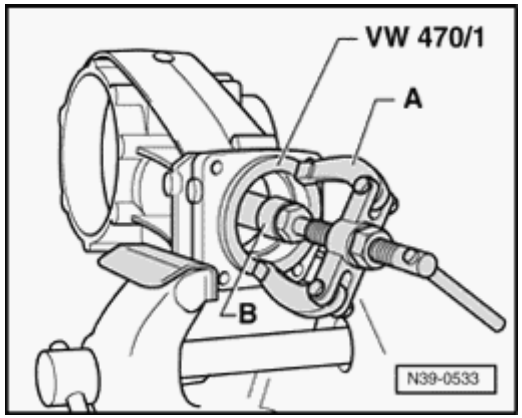


Fig. 4 Pulling out small tapered roller bearing outer race

A - Support e.g. Kukko 22/2

B - Internal puller 46 to 58 mm, e.g. Kukko 21/7 extractor

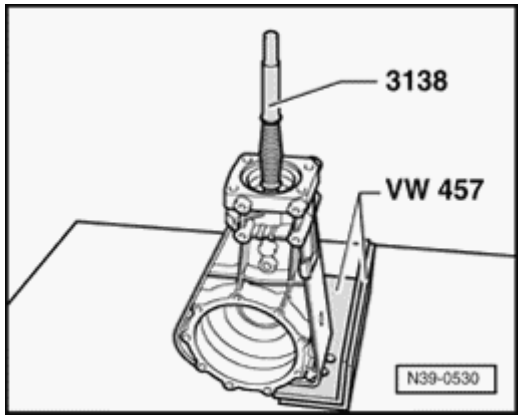


Fig. 5 Driving out large tapered roller bearing outer race

- Check adjustment shims for damage after removing.

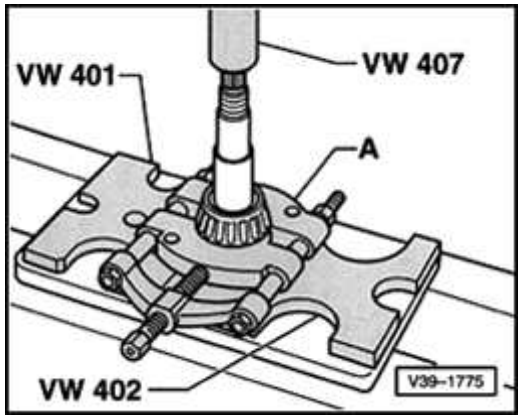


Fig. 6 Pressing off large tapered roller bearing inner race from drive pinion

A - Separating device 22-115 mm, e.g. Kukko 17/2 separating tool

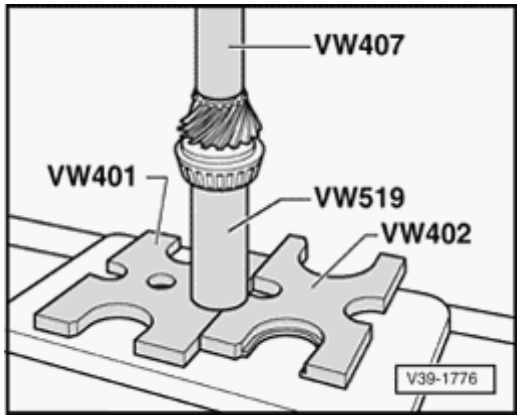


Fig. 7 Pressing large tapered roller bearing inner race onto drive pinion

WARNING!

Wear protective gloves!

- Heat inner race to approx. 100 ° C ,position and press on.

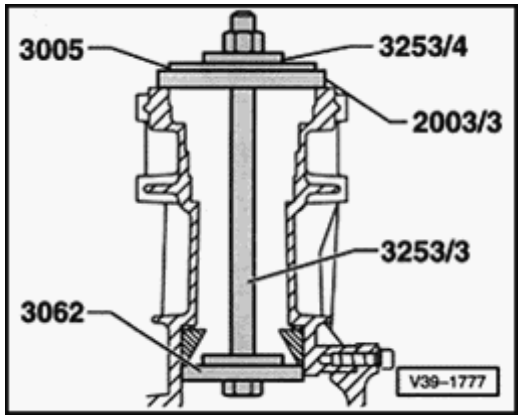


Fig. 8 Pulling in large tapered roller bearing outer race

- Insert previously determined adjustment shim "S3" for drive pinion ⇒ page 39-177 .

Note:

On 3253/4 pressure disc, marking "Oben" points toward nut on installation device

39-163

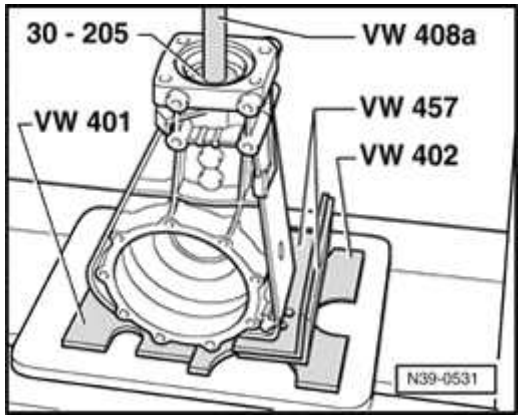


Fig. 9 Pressing in small tapered roller bearing outer race

- The outer race must be oiled and installed using VW408A punch and 30-205 thrust pad.

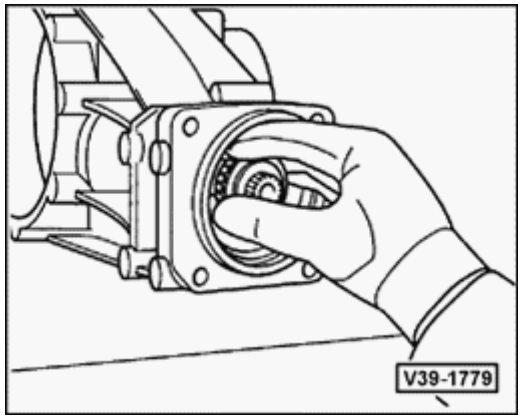


Fig. 10 Pressing on small tapered roller bearing inner race

WARNING!

Wear protective gloves!

- Insert drive pinion with a new spacer sleeve.
- Heat up small tapered roller bearing inner race to approx. 100 °C and insert on drive pinion.
- Press drive pinion upward and insert bearing up to stop using 40-21 sleeve.

39-164

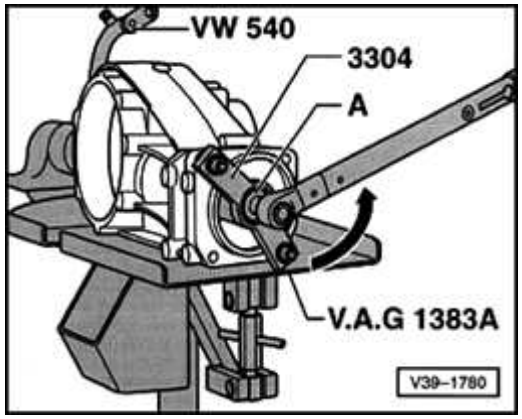


Fig. 11 Tightening drive pinion nut and adjusting friction torque

- Install 3304 retainer using two hex bolts M8 x 30.
- When tightening nut, support final drive (e.g. using VAG1359/2 universal mount with VAG1383A transmission hoist).
- Always replace drive pinion nut.
- Tighten nut for drive pinion until no more drive pinion backlash is present.
- Tighten further until specified friction torque is attained; while tightening measure friction torque multiple times ⇒ Fig. 12 .

Note:

If the specified friction torque is surpassed, replace spacer sleeve and repeat adjustment! Any spacer sleeve that has been pressed together too far one time must be replaced.

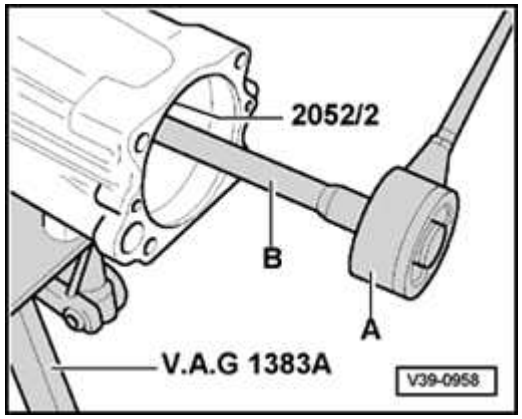


Fig. 12 Measuring friction torque

A - Standard torque gauge, 0 to 600 Ncm

B - Extension with 32 mm wrench socket

- Adjust to following friction torque

New bearings	Run-in bearings 1)
200 to 250 Ncm	30 to 60 Ncm

1) have been run in at least 50 km

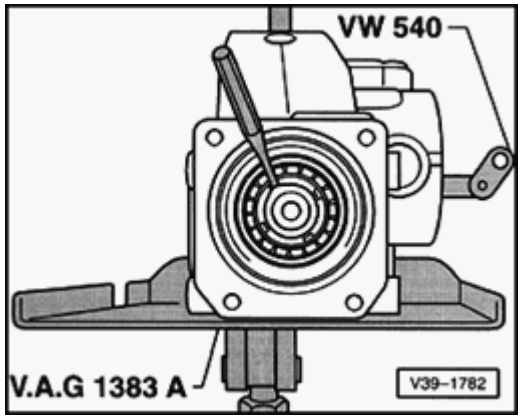


Fig. 13 Removing drive pinion nut

- Peen drive pinion nut using mandrel.

Drive pinion and ring gear, adjusting

General notes:

- *Drive pinion and ring gear must be very carefully adjusted to ensure long service life and smooth running. At the factory, drive pinion and ring gear are adjusted relative to each other to ensure smooth running and low noise in both directions. The location for the smoothest running is determined by moving drive pinion axially whereby ring gear is moved far enough out of the backlash-free position so that the backlash is within specified tolerances.*

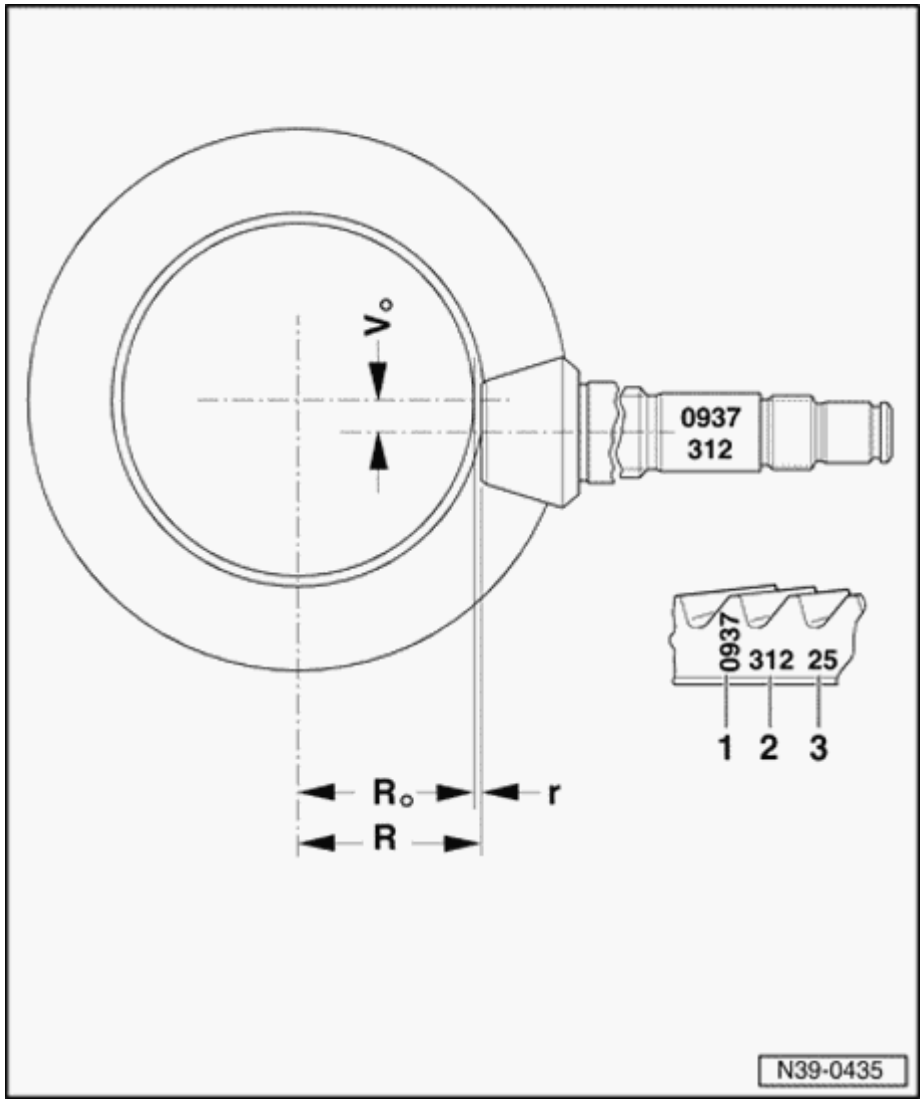
- *The goal of the adjustment is to reproduce the setting for the quietest possible running, as obtained on the test machine during production.*

- *The deviation, or tolerance "r" which is based on the master gauge "R0" is measured for the final drive sets supplied as replacement parts and marked on the outer circumference of the ring gear. Every drive pinion set - drive pinion and ring gear - may only be replaced together.*

- *Follow general repair notes for tapered roller bearings and shims.*

- *Make sure that all installation and measurement procedures are performed with the utmost care and cleanliness to ensure a successful result.*

39-167



Gear set, adjusting and marking

1 - Identification "0937" means the Oerlikon gear set with a ratio of 37: 9.

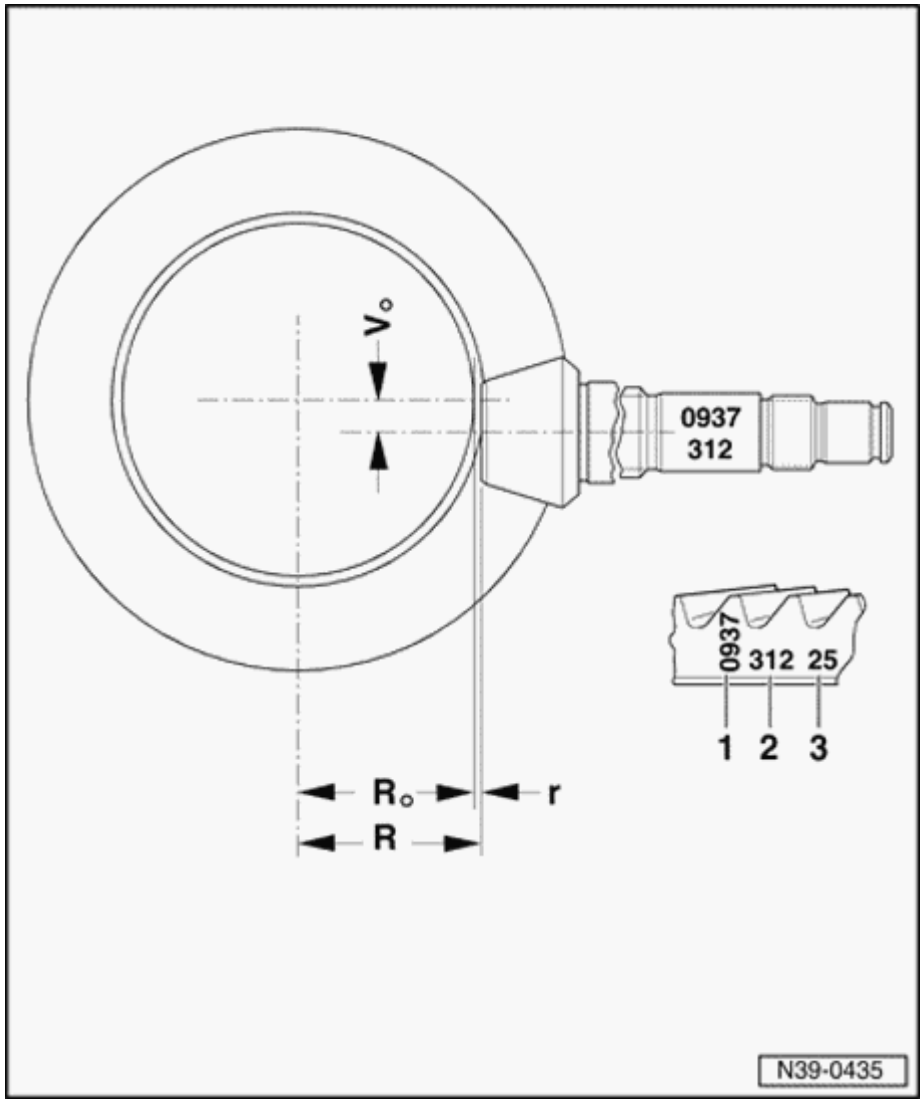
2 - Pairing number (312) of gear set.

3 - Dimension "r" is based on the master gauge used on the test bench during production. Dimension "r" is always given in 1/100 mm. Example: "25" means r = 0.25 mm

Ro - Length of test machine master gauge used "Ro".

Ro - ring gear = 57.50 mm

39-168



R - Actual dimension between ring gear axis and face of drive pinion in position of quietest running for this gear set R = Ro + r

Vo - Hypoid offset

Gear set, adjustment sequence

If drive pinion and gear ring have to be adjusted, the following sequence is recommended for maximum efficiency:

1.) Determine total shim thickness "Stot"for S1 + S2 for the specified pre-tension of tapered roller bearings for differential.

2.) Determine total shim thickness "S3" so that the drive pinion is installed in the same location as on the test machine during production.

3.) Distribute total shim thickness Stotal S1 + S2, so that the specified backlash between ring gear and drive pinion is maintained.

Note:

Overview of components and adjustment shims
⇒ *page 39-171* .

39-170

Adjustment overview

Note:

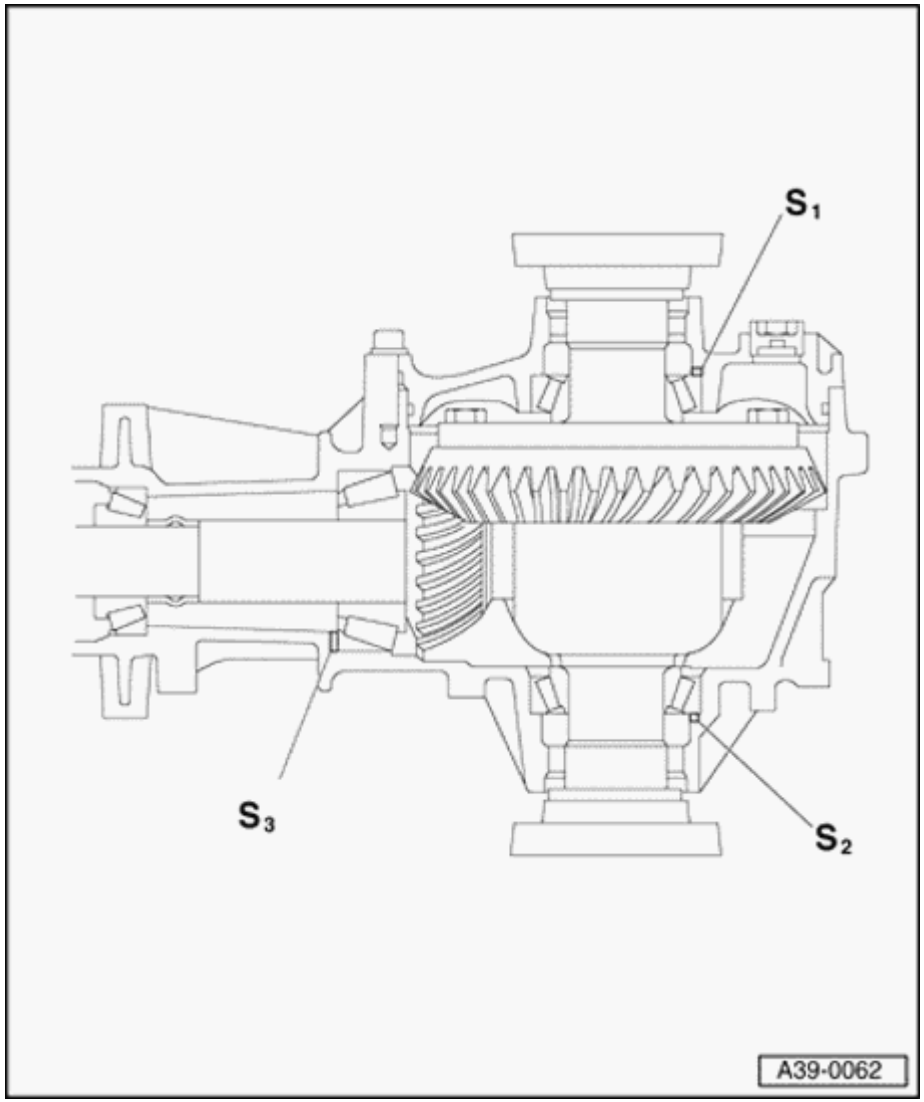
When working on transmission, drive pinion or gear set only need to be adjusted if components were replaced which directly influence the final drive. Note the follow table to prevent unnecessary adjustments:

	Component to be adjusted:		
Component replaced: ▼	Ring gear "S1"+"S2" 1) ⇒ page 39-186	Drive pinion "S3" 1) via deviation "r" ⇒ page 39-177	Backlash Checking ⇒ page 39-192
Final drive housing	X	X	X
Differential housing	X		X
Tapered roller bearing for drive pinion		X	X
Tapered roller bearing for differential	X		X
Gear set 2)	X	X	X
Cover for final drive	X		X

1) Adjustment shims; Installed position ⇒ page 39-171

2) Drive pinion and ring gear; only replace together as a set

39-171



Shim location

Note:

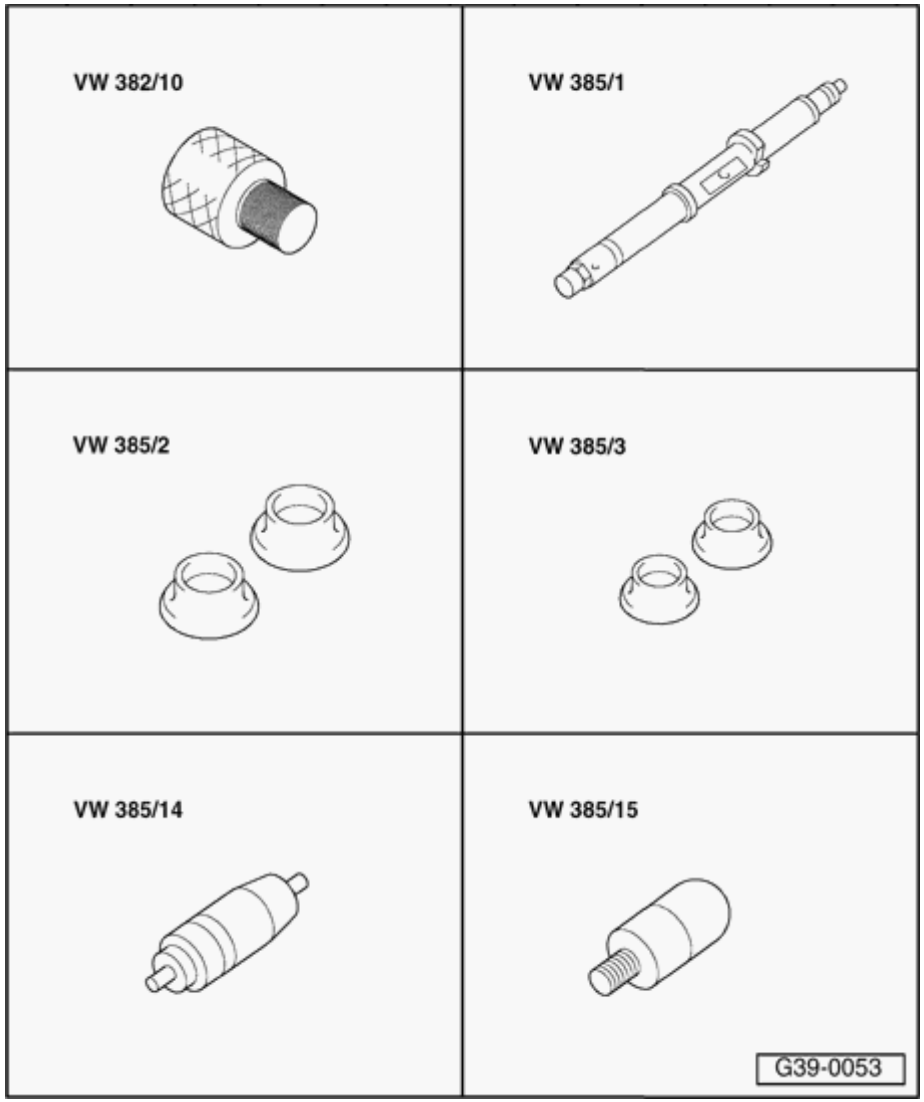
Adjustment overview when replacing individual components of differential ⇒ *page 39-170* .

S1 - Adjustment shim for ring gear in final drive cover

S2 - Adjustment shim for ring gear in final drive housing

S3 - Adjustment shim for ring gear in final drive housing

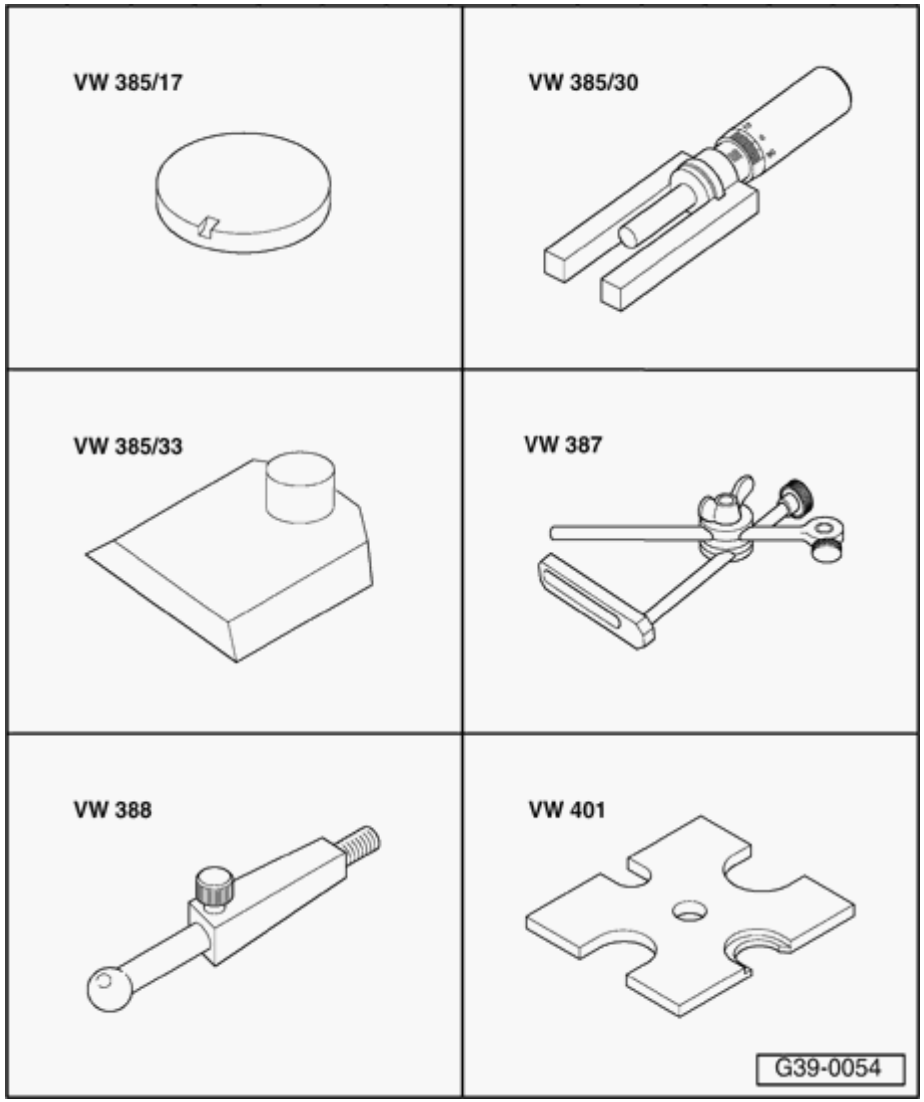
39-172



Special tools and equipment

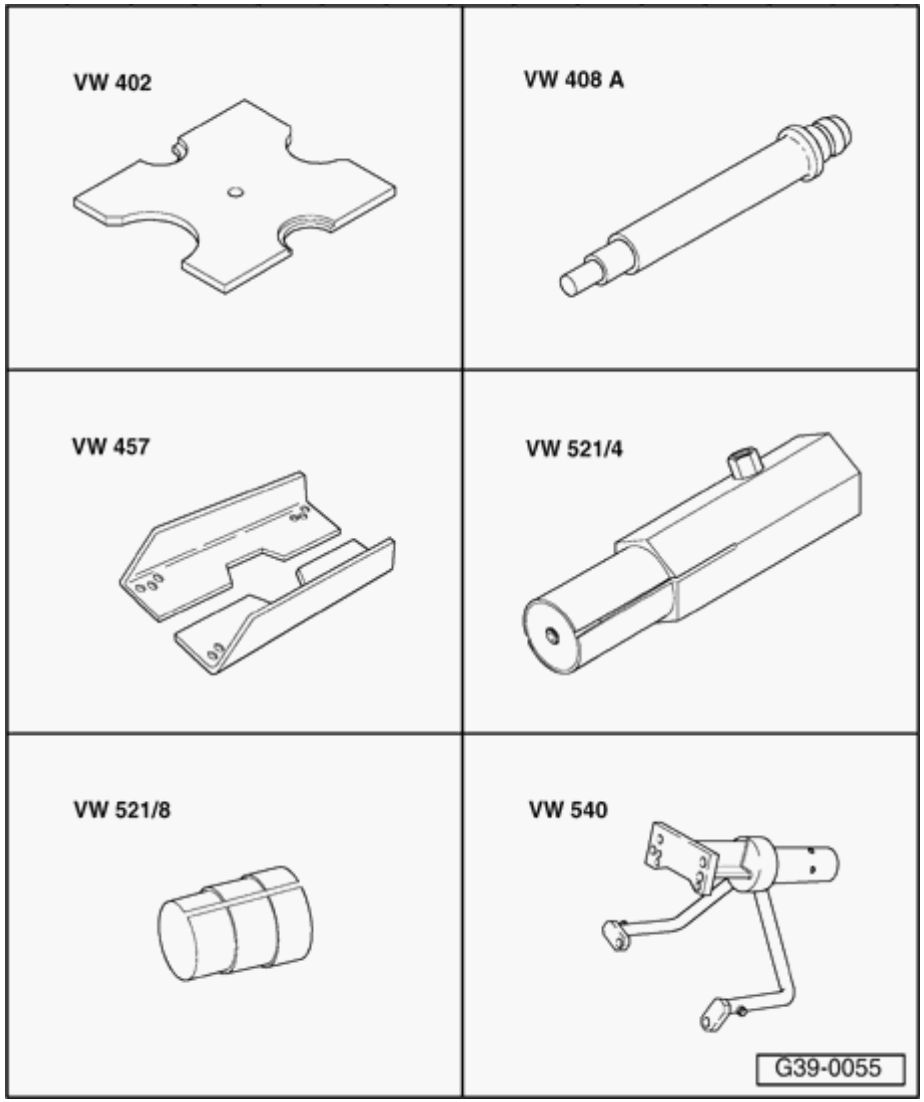
- VW382/10 extension pin
- VW385/1 measuring bar
- VW385/2 centering disc
- VW385/3 plastic piece
- VW385/14 measuring rod
- VW385/15 extension pin

39-173



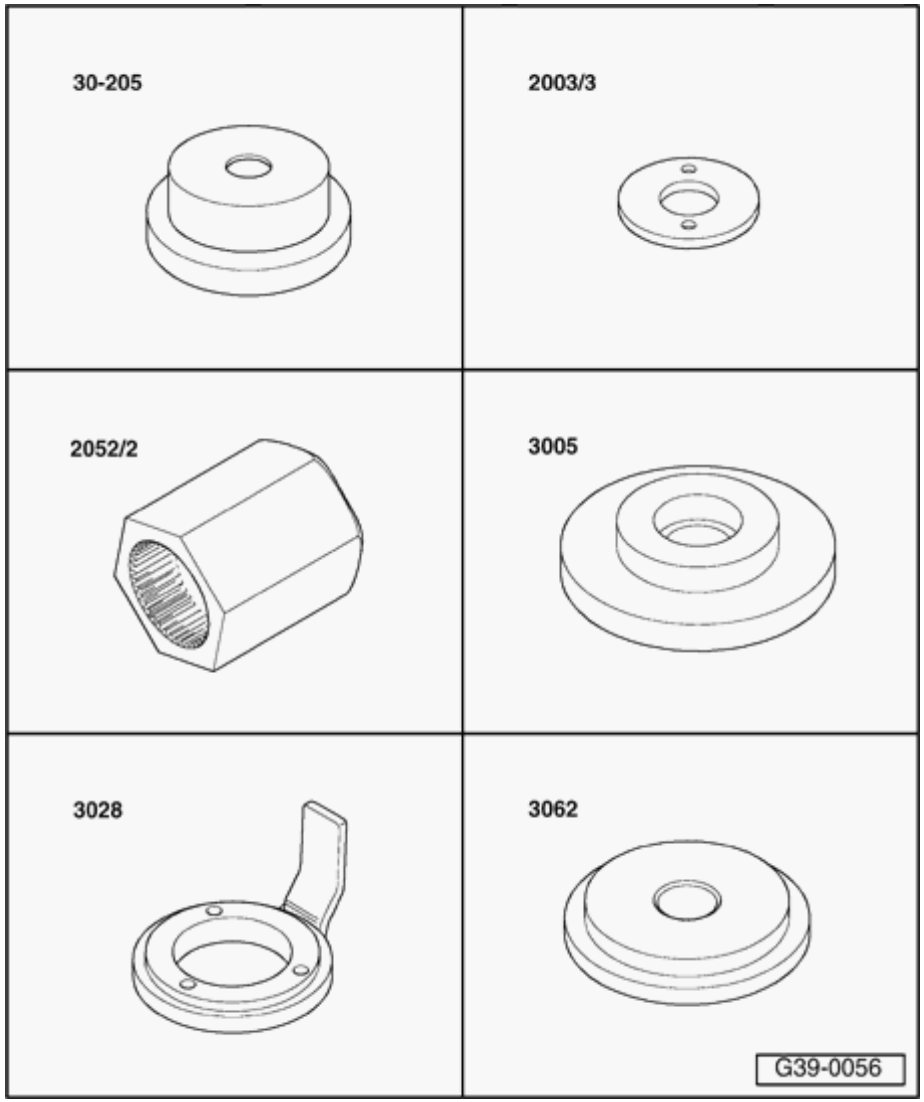
- VW385/17 magnetic plate
- VW385/30 master gauge-adjustable
- VW385/33 end gauge
- VW387 dial gauge holder
- VW388 measuring lever
- VW401 thrust plate

39-174



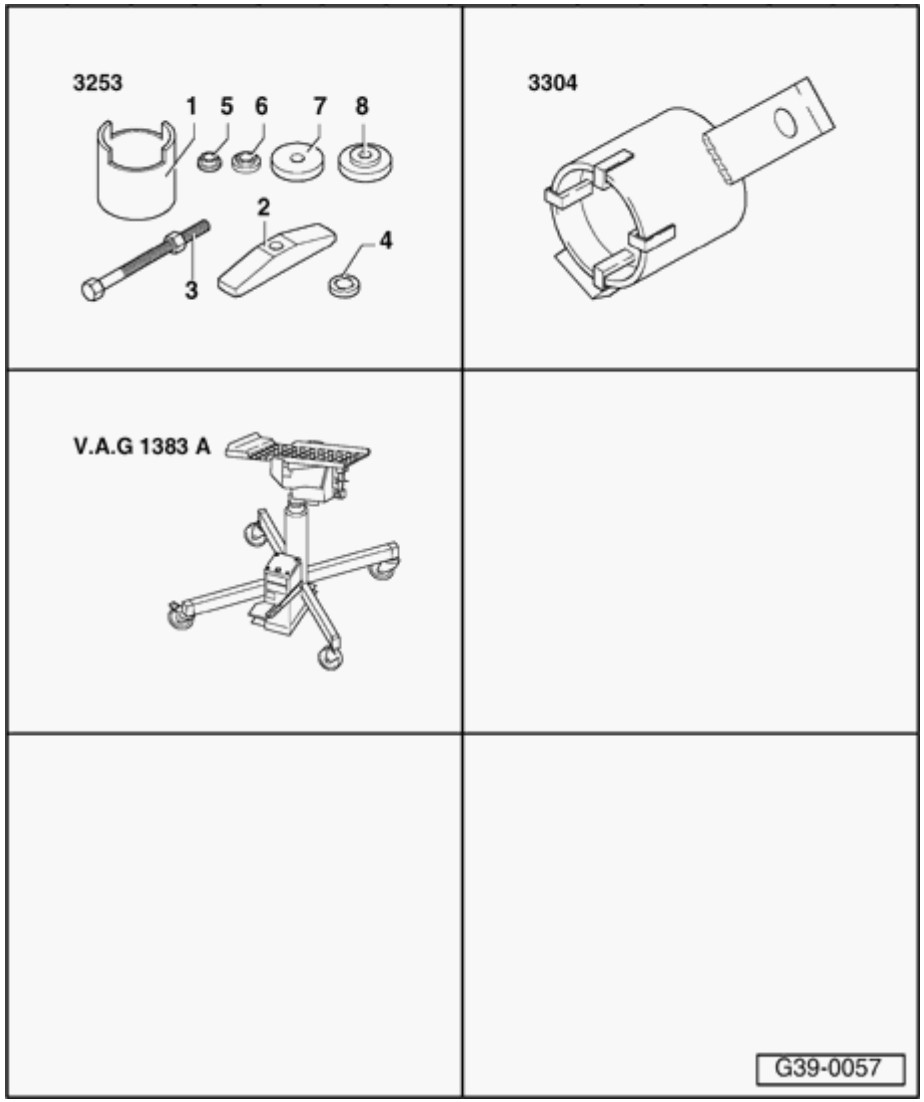
- VW402 thrust plate
- VW408A punch
- VW457 support channels
- VW521/4 locking sleeve for ring gear
- VW521/8 bushing for ring gear
- VW540 holding fixture

39-175



- 30-205 thrust pad
- 2003/3 seal installer
- 2052/2 assembly tool for drive pinion
- 3005 thrust pad
- 3028 retainer
- 3062 thrust pad

39-176



- 3253 wheel bearing assembly set with 3253/3 and 3253/4
- 3304 retainer
- Engine/transmission jack VAG1383A engine/gearbox jack
- Dial gauge extension 30 mm
- Dial gage
- Torque gauge 0 - 600 Ncm

39-177

Drive pinion, adjusting

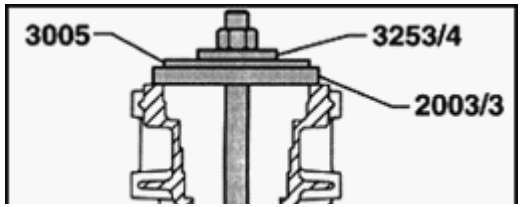
Notes:

- *Before adjusting drive pinion, adjust ring gear (determine total shim thickness "S" total" for adjustment shims "S1" + "S2")* ⇒ *page 39-186* .
- *Drive pinion only has to be adjusted again if gear set, tapered roller bearings for drive pinion or final drive housing was replaced. Adjustment overview* ⇒ *page 39-170* .
- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*

Determining Shim "S3"

(adjust preload of tapered roller bearing for drive pinion)

- Clamp final drive into engine and transmission assembly stand ⇒ page 39-123 .

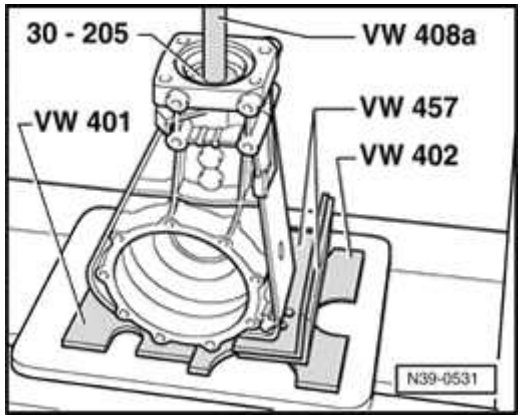


- Pull large tapered roller bearing outer race into housing.

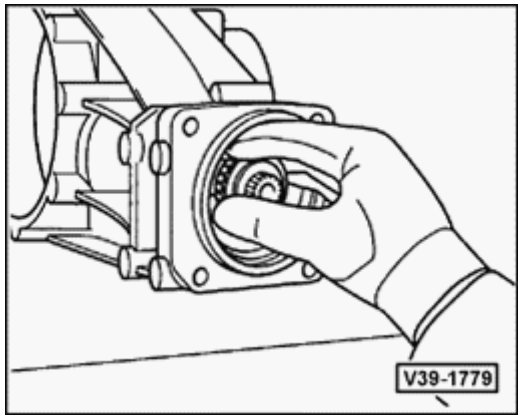
Note:

On 3253/4 pressure disc, marking "Oben" points toward nut on installation device

39-178



- Pulling small tapered roller bearing outer race into housing.
- The outer race must be oiled and installed using VW408A punch and 30-205 thrust pad.



- Install drive pinion without spacer sleeve.

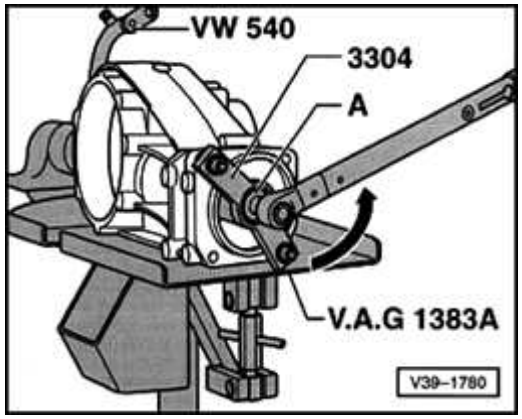
WARNING!

Wear protective gloves!

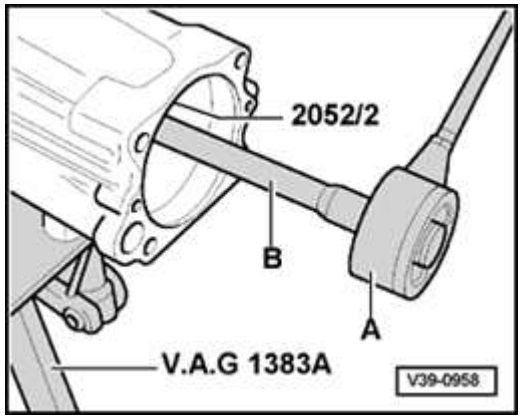
- Heat up small tapered roller bearing inner race to approx. 100 °C and position on drive pinion.

Notes:

- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*
- *Only install spacer sleeve if friction torque has been adjusted (Shim S3 already determined).*



- Install 3304 retainer using two hex bolts M8 x 30.
- When tightening nut, support final drive (e.g. using VAG1359/2 universal mount with VAG1383A transmission hoist).
- Always replace drive pinion nut.
- Tighten nut for drive pinion until no more drive pinion backlash is present.
- Increase tightening torque further until specified friction torque is attained; while tightening measure friction torque multiple times.



A - Standard torque gauge, 0 to 600 Ncm

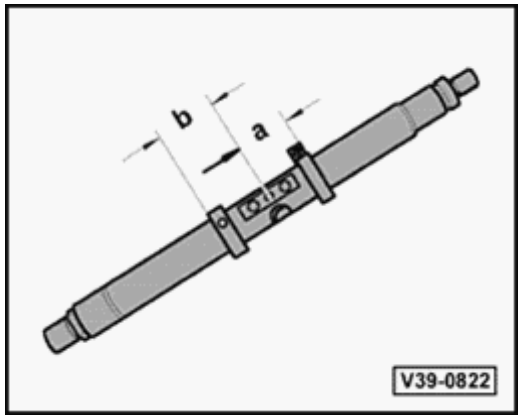
B - Extension with 32 mm wrench socket

- Adjust to following friction torque

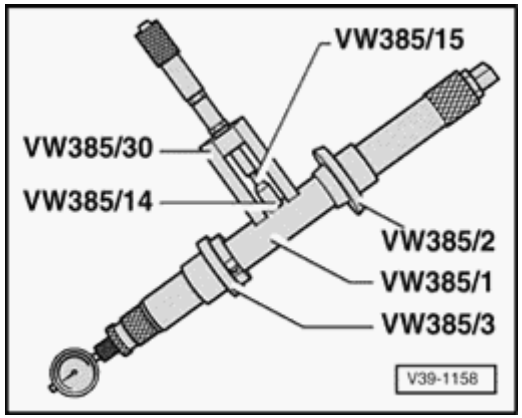
New bearings	Run-in bearings [1)]
200 to 250 Ncm	30 to 60 Ncm

[1)] have been run in at least 50 km

39-180



- Adjust adjustment ring of VW385/1 measuring bar.
  - Dimension a = 60 mm
- Adjust sliding adjustment ring.
  - Dimension b = 55 mm

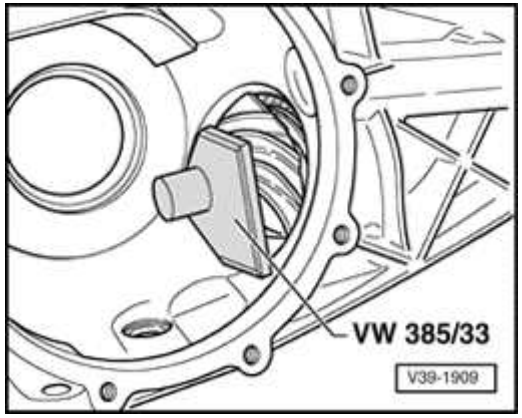


- Assemble measuring bar as shown in illustration.
  - VW385/15 extension pin 9 mm
- Adjust VW385/30 master gauge-adjustable.
  - Ro = 57.50 mm
- Set dial indicator (3 mm measuring range) to 0 with 2 mm preload.

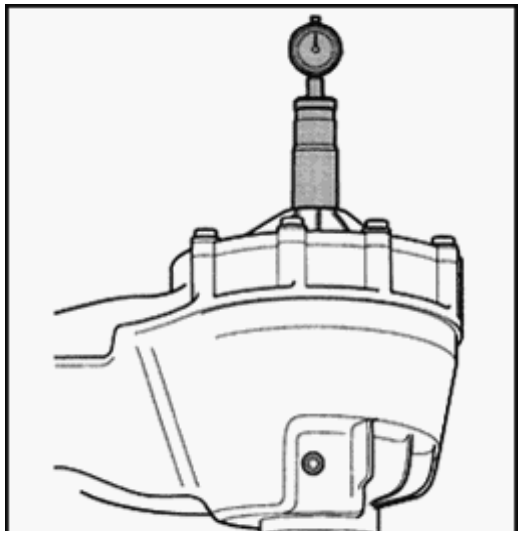
39-181

Note:

Turn differential at least 5 rotations in each direction to seat the tapered roller bearings. Otherwise, measurement will result in false readings.

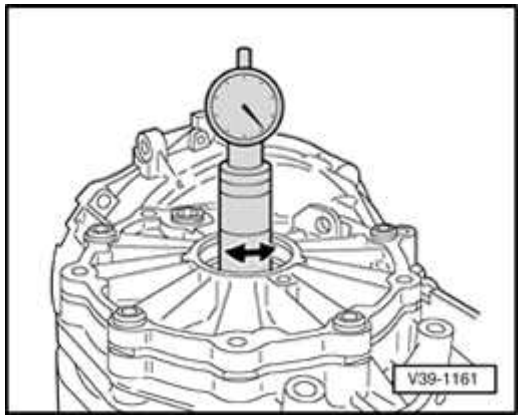


- Position VW385/33 end gauge on drive pinion head.



- Remove master gauge and insert measuring mandrel into housing.
  - VW385/3 plastic piece faces final drive cover
- Install cover for final drive and tighten four bolts.
- Using adjustable ring, pull 2nd centering disc out far enough, so that the mandrel can only just be turned by hand.

39-182



Determining dimension "e"

- Turn measuring mandrel until dial indicator plunger tip touches end gauge on pinion shaft head, and measure the maximum run-out (return point). Measured value is dimension "e" (red numbered area).
  - Measured value in the following example: "e" = 1.60 mm

Note:

Dimension "e" is required to determine thickness of S3 shim.

- After removing universal mandrel, and with VW385/30 master gauge in place, check dial indicator again to see if it indicates 0, with 2 mm preload. If not, repeat measurement.

Determining thickness of shim "S3"

Formula:

"S3" = "e" - "r"

e = determined value

r = deviation (indicated in 1/100 mm on ring gear)

Example:

	determined value "e"	1.60 mm
-	Deviation "r"	0.42 mm
=	Thickness of shim "S3"	1.18 mm

- Determine shim as closely as possible according to table. Part numbers

⇒ *Parts-catalog*

Available shims for S3

Adjustment shim thickness (mm) 1)		
0.95	1.20	1.45
1.00	1.25	1.50
1.05	1.30	1.55
1.10	1.35	
1.15	1.40	

1) By using shim tolerances, it is possible to determine the exact shim thickness required, insert two shims if necessary

- Removing universal mandrel.

- Remove drive pinion and large tapered roller bearing outer race and install together with determined adjustment shim "S3" and spacer sleeve ⇒ Page 39-159 onward.

- Insert small tapered roller bearing inner race and tighten nut for drive pinion until specified friction torque is attained ⇒ Fig. 11 , ⇒ page 39-164 .

Notes:

- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*

- *Increase torque slowly and measure friction torque multiple times. If the specified friction torque is surpassed, replace spacer sleeve and repeat adjustment! Any spacer sleeve that has been pressed together too far one time must be replaced.*

- Adjust friction torque to following values:

New bearings	Run-in bearings 1)
200 to 250 Ncm	30 to 60 Ncm

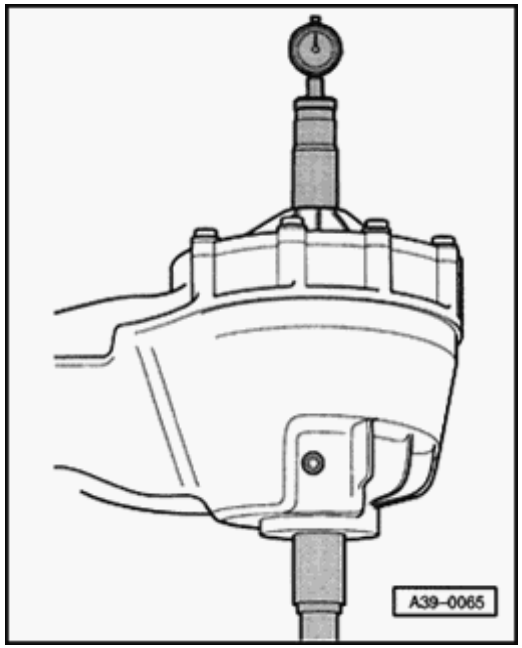
[1)] have been run in at least 50 km

39-185

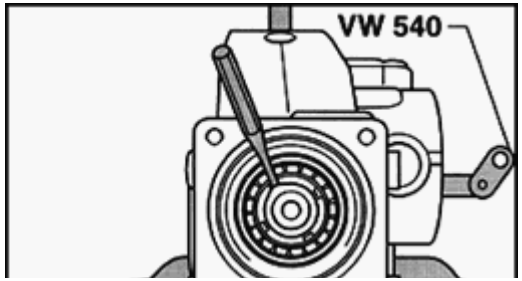
Perform check measurement

Checking dimension "r"

- Rotate drive pinion at least 5 complete revolutions in both directions.



- Insert universal mandrel and perform check measurement.
  - ♦ If adjustment shims were determined correctly, dial indicator must indicate deviation "r" with a tolerance of ± 0.04 mm (reading counterclockwise in red number display).



- Peen drive pinion nut using mandrel.

39-186

Ring gear, adjusting

(Adjusting differential)

Procedures after which the ring gear must be adjusted ⇒ Adjustment overview ⇒ page 39-170 .

Notes:

- *Tapered roller bearings for differential are low-friction bearings. Therefore friction torque can only be used for check measurement in a limited way. A correct adjustment is only possible by determining the total thickness "Sges".*

- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*

Total shim thickness "Stotal" for adjustment shims "S1" + "S2", determining

(adjust preload of tapered roller bearing for differential)

- Drive pinion removed or ring gear detached from differential housing

- Pry out drive flange seal using tire iron.

- Remove tapered roller bearings for differential and remove adjustment shims ⇒ page 39-136 .

- Press tapered roller bearing outer race for left side of differential housing (housing side) together with shim "S2" into differential housing ⇒ Page 39-144 . Use a shim "S2*" with a 1.00 mm thickness for measurement purposes (1 shims with 0.80 and 1 with 0.20 mm).

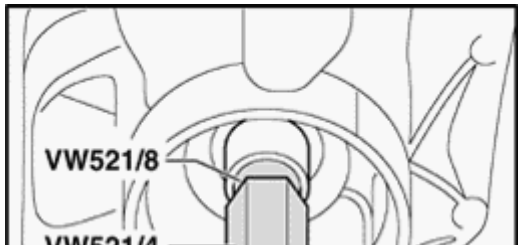
Note:

All measurements are performed with shim S2 with 1.00 mm thickness. The shim will be indicated by "S2" in the following procedures. After determining backlash, S2* is replaced by final shim S2.*

- Press in tapered roller bearing outer race for right side (cover side) of differential without adjustment shims to stop ⇒ Fig. 8 , ⇒ page 39-136 .

- Insert differential in housing. Ring gear is on the right side (cover side).

- Install cover and tighten bolts to 25 Nm.

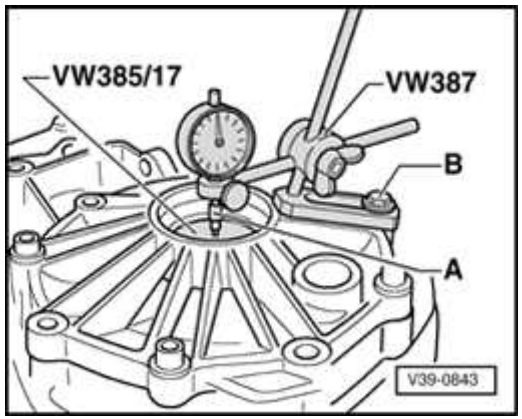


- Install VW521/4 locking sleeve and 521/8 sleeve press tool into differential housing on housing side.
- Rotate cover side of differential housing upward.

39-188

- Turn differential 5 rotations in each direction to seat the tapered roller bearing.

- Place VW385/17 magnetic plate onto differential.

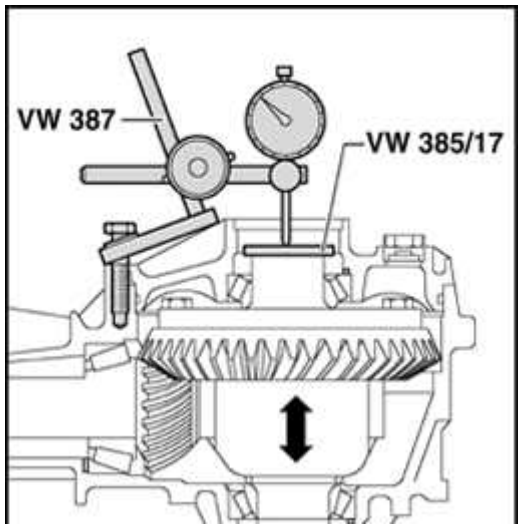


- Install measuring tools.

A - Dial gauge extension approx. 30 mm long

B - Hex bolt M8 x 45

- Set dial gauge extension onto center of VW 385/17 magnetic plate.
- Set dial indicator (3 mm measuring range) to 0 with 2 mm preload.



- Lift the differential without turning it, read play on dial indicator and note.
  - Measured value in the following example: 0.50 mm

Note:

If measurement is repeated, differential must first be rotated 5 complete revolutions in both directions again to seat tapered roller bearing.

39-189

Formula:

"Stotal" = "S2*" + measured value + bearing preload

Example:

	Installed shim(s) "S2*"	1.00 mm
+	Measurement	0.50 mm
+	Bearing preload (constant)	0.30 mm
=	Total shim thickness "Stotal"for shims "S1" + "S2"	1.80 mm

Determining thickness of shim "S1*"

Notes:

- *"S1*" is used for the initial measurement. After determining backlash, "S1*" is replaced with final shim "S1".*
- *The total shim thickness "Stotal" remains unchanged.*

Formula:

"S1*" = "Stotal" - "S2*"

Example:

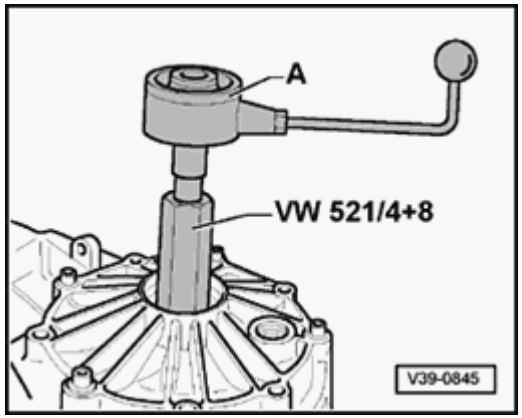
	Total shim thickness "Stotal"for shims "S1" + "S2"	1.80 mm
-	Installed shim(s) "S2*"	1.00 mm
=	Thickness of shim "S1*"	0.80 mm

- Determine adjustment shim(s) as closely as possible according to table ⇒ page 39-195 .

39-191

Measuring friction torque (check measurement)

- Drive pinion removed
- Differential installed with shims "S1*" and "S2*"



- Position torque gauge 0 to 600 Ncm -A- on differential.
- Read friction torque.

Friction torque specified values:

New bearings	Run-in bearings 1)
150 to 300 Ncm	30 to 60 Ncm

1) have been run in at least 50 km

Notes:

- *Tapered roller bearings for differential are low-friction bearings. Therefore friction torque can only be used for check measurement in a limited way. A correct adjustment is only possible by determining the total thickness "Sges".*
- *Do not grease new tapered roller bearings additionally for friction torque measurement. The bearings are already greased with a special oil from the factory.*
- *For a new adjustment of the gear set, the drive pinion adjustment*

should now be checked ⇒ page 39-177 .

39-192

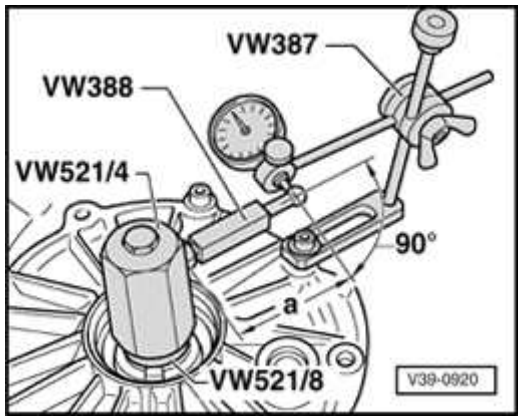
Adjusting backlash

(position of ring gear in transmission housing)

- Drive pinion installed with shim S3
- Differential installed with shims "S1*" and "S2*"

- Insert differential into final drive housing, install cover and tighten all bolts to 25 Nm.

- Turn differential 5 rotations in each direction to seat the tapered roller bearing.



- Install measuring tools.
- Use VW382/10 extension pin, 6 mm.
- Set VW388 measuring lever to dimension "a" = 60 mm.
- Determine backlash between teeth flanks as follows:
  - Turn ring gear until it contacts a tooth flank (end of backlash travel).
  - Set dial indicator to 0 with 1 mm preload.

- Turn ring gear back until it contacts opposite tooth flank (backlash).

- Read backlash and note.

- Turn ring gear an additional 90° in each case and repeat measurement 3 times.

Note:

If measurements vary more than 0.06 mm from each other, ring gear or gear set is not installed correctly. Check installation, replace gear set if necessary.

Determining average backlash

Example:

	1. Measurement	0.28 mm
+	2. Measurement	0.30 mm
+	3. Measurement	0.30 mm
+	4. Measurement	0.28 mm
=	Total of measurements	1.16 mm

- Result: The average backlash is 1.16 mm / 4 = 0.29 mm

Determining thickness of shim "S2"

Formula:

"S2" = "S2*" - backlash + lift

Example:

	Installed shim "S2*"	1.00 mm
-	Average backlash	0.29 mm
+	Lift (constant)	0.15 mm
=	Thickness of shim "S2"	0.86 mm

- Determine shim as closely as possible according to table. Part numbers

⇒ *Parts-catalog*

Available shims for S2

Adjustment shim thickness (mm) 1)		
0.15	0.50	1.50
0.20	0.80	
0.25	1.00	

1) By using shim tolerances, it is possible to

determine the exact shim thickness required, insert two shims if necessary

Determining thickness of shim "S1"

Formula:

"S1" = "Stotal" - "S2"

Example:

	Total shim thickness "Stotal" for "S1" + "S2"	1.80 mm
-	Thickness of shim "S2"	0.86 mm
=	Thickness of shim "S1"	0.94 mm

- Determine shim as closely as possible according to table. Part numbers

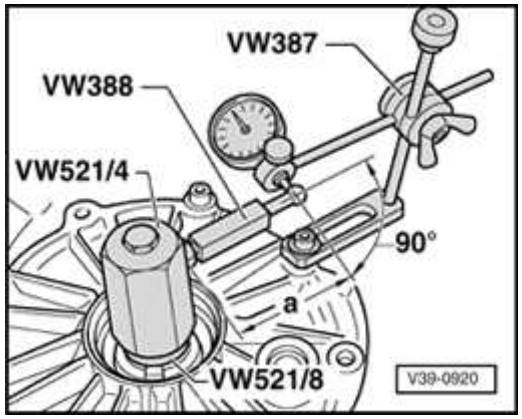
⇒ *Parts-catalog*

Available shims for S1

Thickness of adjustment shims in mm[1)]		
0.15	0.50	0.90
0.20	0.60	1.00
0.30	0.70	1.20

0.40	0.80	

1) By using shim tolerances, it is possible to determine the exact shim thickness required, insert two shims if necessary



Checking measurement

- Drive pinion installed with shim S3
- Differential installed with shims "S1" and "S2"

- Turn differential 5 rotations in each direction to seat the tapered roller bearing.
- Measure backlash 4 times on circumference.
  - Specification: 0.12 to 0.22 mm

Notes:

- *If backlash is outside tolerance, repeat adjustments. Do not change total shim thickness "Stotal" while doing so.*
- *The individual measurement values can deviate a maximum of 0.06 mm from each other*